Rcd 3/10/97

Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa
November 1996 Sampling

Prepared for

StarKist Samoa
NPDES Permit AS0000019
and
VCS Samoa Packing
NPDES Permit AS0000027

Submitted to

U.S. Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL
and
gdc

7 March 1997

Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa

November 1996 Sampling

Prepared for

StarKist Samoa

NPDES Permit AS0000019

and

VCS Samoa Packing

NPDES Permit AS0000027

Submitted to

U.S. Environmental Protection Agency

and

American Samoa Environmental Protection Agency

Prepared by

CH2M HILL

and

gdc

7 March 1997

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

1. INTRODUCTION

This report describes the second semi-annual Pago Pago Harbor water quality monitoring field measurements done under the revised NPDES permit condition (E) for VCS Samoa Packing and StarKist Samoa. The letter from the U.S. Environmental Protection Agency implementing the changes in the permits, and the revised permit condition are included as Appendix I. The revisions apply to both permits for discharge through the Joint Cannery Outfall (JCO): VCS Samoa Packing holds NPDES permit AS0000027and StarKist Samoa holds NPDES permit AS0000019. The overall purpose of this study and the purpose of this report, a description of the study site, a brief background of the water quality monitoring work done in the Harbor, and the scope and organization of this report are described below in this section of the report. Following sections of the report describe the field data collection, the laboratory results of samples collected, and conclusions and recommendations based on the results.

1.1 PURPOSE

The purpose of the Receiving Water Quality Monitoring Program is, as described in the permit, "to determine compliance with water quality standards". To achieve this the program must, as described in the permit, "document water quality at the outfall, at areas near the zone of initial dilution (ZID) and zone of mixing (ZOM) boundaries, at areas beyond these zones where discharge impacts might reasonably be expected, and at reference/control areas". The purpose of this report is to document the second set of data, collected during November 1996, and to evaluate these data in terms of compliance with water quality standards. The second monitoring episode was originally scheduled for October 1996, but was delayed with the approval of USEPA

1.2 STUDY LOCATION

Water quality measurements and samples were obtained throughout Pago Pago Harbor, Tutuila Island, American Samoa. The island is located approximately 2300 miles southwest of Hawaii, 1600 miles northeast of New Zealand, and 1000 miles south of the equator at latitude 14° 17′ S and longitude 171° 40′ W (approximately). The general location is shown in Figure 1-1. The harbor is approximately 15,000 feet long with the entrance to the south. The outer harbor trends north-south with widths varying between 3000 and 6000 feet. The inner harbor trends east-west with the head of the harbor to the west and ranges from less than 1000 to about 3000 feet wide. Figure 1-2 shows the general harbor morphology. Maximum depths along a cross section range from less than 60 to over 200 feet, with fringing reefs periodically exposed at low tide throughout the middle and outer harbor areas.

The climate is tropical with about 200 inches of rainfall annually, air temperatures typically between 70 and 90°F, and high humidity. Orographic effects create higher rainfall in the

vicinity of the harbor than at other locations on the Island. The watershed of the harbor is small relative to the harbor size with about 4.9 mi^2 of drainage area compared to about 2.4 mi^2 of water surface area. Therefore, the harbor is typically a marine dominated system with depressed salinities normally found only very close to stream mouths.

Tides are semi-diurnal with a range of about 2.5 feet and little diurnal inequality. The circulation in the Harbor is mainly wind driven with both tidal and freshwater influences generally very small except at extremely localized sites. Winds are usually from the east and southeast and are from this direction most of the time during the tradewind season, which is typically April/May through October/November. During November/December through March/April the east to southeast winds still predominate but a northwest to northeast component becomes more prevalent (the non-tradewind season).

The tuna canneries discharge through the JCO which terminates in a mulitport diffuser at a depth of approximately 176 feet in the outer harbor (see Figure 1-3). Typical flows through the outfall are approximately 2 mgd. The discharge is in the center of a mixing zone for total nitrogen (TN) and total phosphorous (TP) as shown in Figure 1-3. A small mixing zone for ammonia has also been established and is defined within 12 meters of the diffuser discharge ports.

1.3 BACKGROUND

Prior to the implementation of high strength waste segregation and outfall relocation, the canneries discharged treated wastewater into the inner harbor though two outfalls. These outfalls terminated in about 80 feet of water in open-ended pipes without diffusers. In August 1990 both canneries started high strength waste segregation and offshore ocean disposal of the high strength waste streams (those process streams highest in nitrogen, phosphorous, suspended solids, and BOD). In February 1992 both canneries began discharging treated wastewater (without the high strength waste component) through a single outfall, relocated approximately 8400 feet seaward from the previous discharge point, at about the 180-foot contour, in the outer harbor. The new outfall terminates in a diffuser consisting of four active and two inactive ports.

The current NPDES permits for both canneries, which became effective in October 1992, required monthly monitoring of water quality parameters, with emphasis on nutrients, at established monitoring stations throughout the harbor. This monitoring had been carried out by the American Samoa Environmental Protection Agency (ASEPA). In November 1995, USEPA revised the permit condition for reasons given in the notification of revision (Appendix I). The revised water quality monitoring (Appendix I) is similar to, and extends the usefulness of, the original monitoring condition. The major changes in the permit condition include:

- The frequency of sampling was reduced from monthly to semi-annually
- The number of sampling locations was increased from 17 to 20

- The number of sampling depths was changed from three to a maximum six at 30 foot

- Continuous vertical profiles of temperature, salinity, dissolved oxygen, pH, and turbidity, rather than grab samples, are now required

  increments plus near bottom (with a minimum of three samples in shallow water)

- Suspended solids was removed from the list of analytes
- Sampling for zinc and copper was added for seven locations at specified depths

The first of the monitoring episodes required by the revised permit was conducted in March 1996. This report describes the second monitoring episode required by the revised permit, which was conducted in November 1998.

1.4 SCOPE AND ORGANIZATION OF REPORT

The following sections of this report describe the field data collection (Section 2), summarize the data acquired (Section 3), and provide conclusions and recommendations (if any) based on the field data collection and results (Section 4). Section 2 includes specific information on sample station locations and times, field methods, and describes any deviations from the intended study plan. Section 3 presents summaries of field measurements and laboratory results with detailed information referenced to appendices when appropriate. Section 4 includes an evaluation of compliance with American Samoa Water Quality Standards (ASWQS) based on the data collected, and presents recommendations for changes in methodology, sampling strategies, or other requirements as appropriate. References are provided (Section 5) and appendices are included describing the specifics of the permit condition, the study and analysis plan and the revised standard operating procedures (SAP/SOP), and detailed data supplements for field measurements and laboratory analyses.

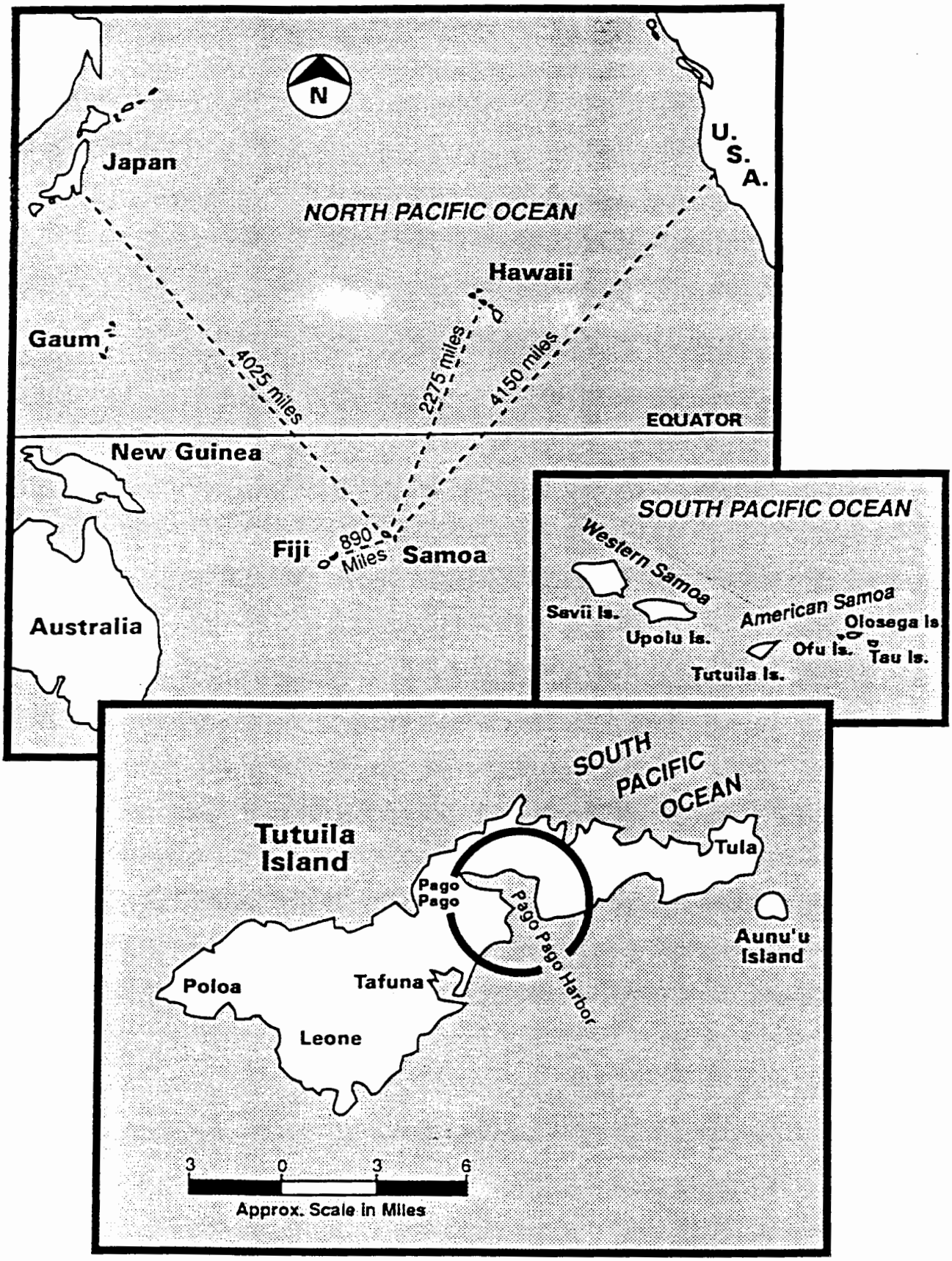


Figure 1-1
Overview of Study Site

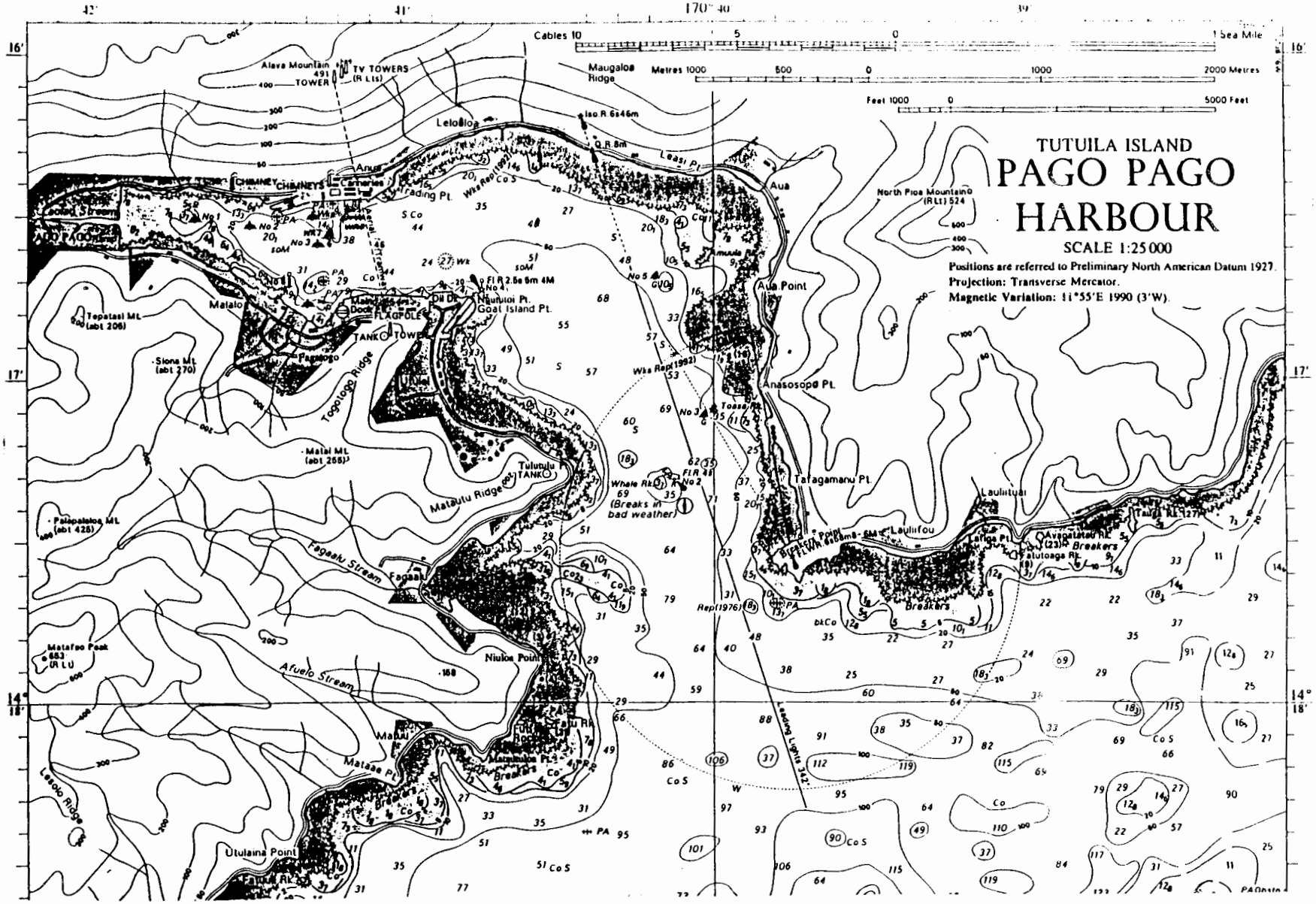


Figure 1-2
Pago Pago Harbor

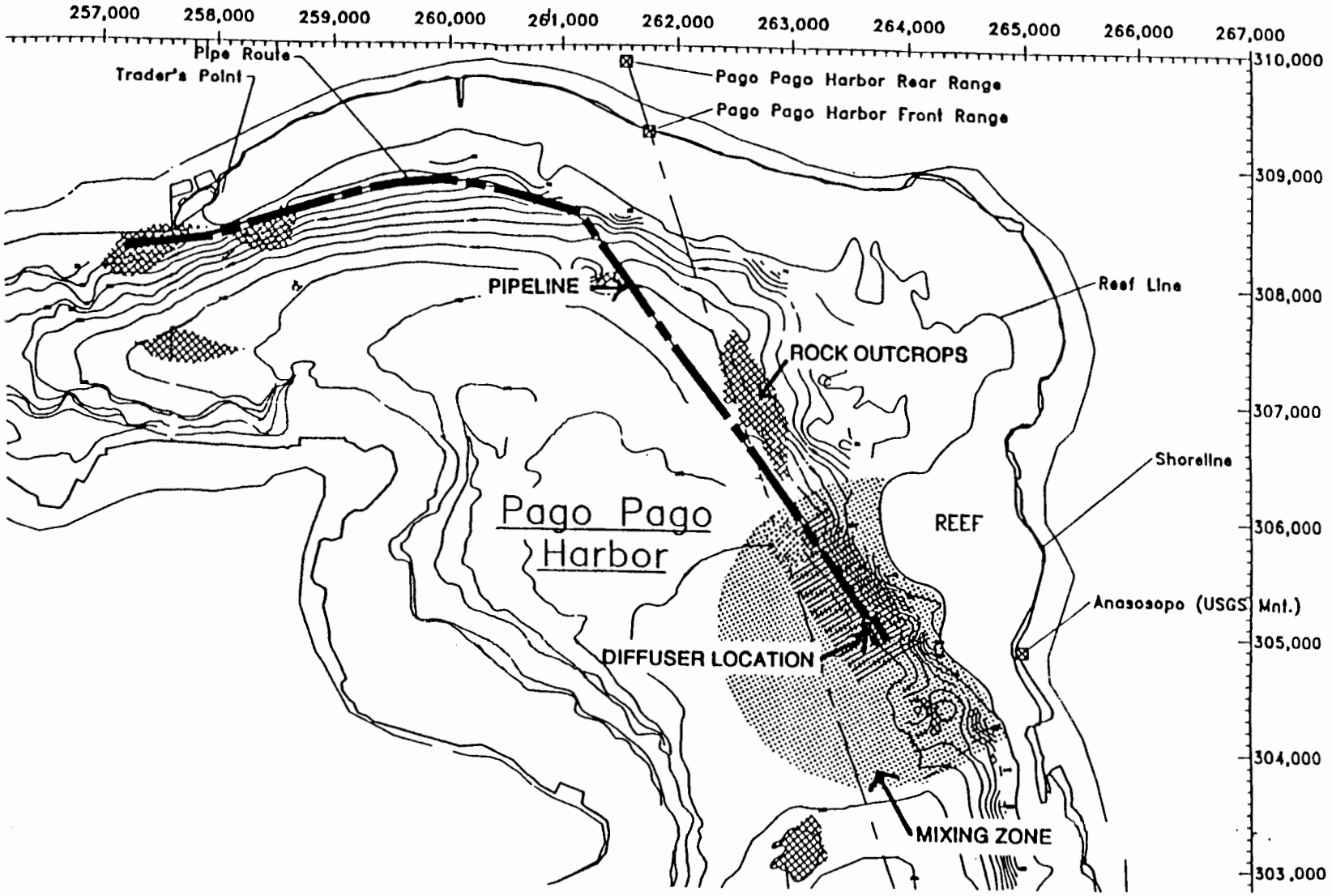


Figure 1-3
Outfall and Mixing Zone Location

2. FIELD DATA COLLECTION

A description of the field data collection during November 1996, including the methods used for field measurements and sample collection are described below. The types of data collected and the locations, dates, and times of measurements and sample collection are summarized. Deviations from the SAP/SOP are listed and discussed.

2.1 GENERAL DESCRIPTION

The field work was conducted between 19 November and 23 November 1996. The activities conducted during this time period included:

- 19 November - Sampling at stations 11,11A, 12, and 13
- 20 November - Sampling at stations 9, 9A, 10, 10A, 15, and 16
- 21 November - Sampling at stations 5, 5A, 7, 8, 8A, 14, and 18
- 22 November - Sampling at stations 6, 6A, and 17
- 23 November - Continuous profile hydrographic casts made at all stations

During sampling at designated stations water samples were collected for laboratory analysis using standard water sampling bottles (Niskin type bottles). Secchi depth and total water depth were measured at each station. Profile casts were made on November 23rd. The dissolved oxygen (DO) probe on the profiling instrument was checked prior to sampling, and was found to give unreliable readings. Attempts to field service the probe were unsuccessful. Therefore, DO was measured for each individual grab sample (at each station and each depth sampled) using a YSI DO meter (temperature and salinity internally compensated). pH was measured either in the field during the collection of individual grab samples, or using a subsample from the chlorophyll-a sample at the time of filtering as described below.

The continuous profile hydrographic casts were done using a SeaBird conductivity, temperature, depth (CTD) instrument also equipped with DO, and turbidity probes. The DO probe was not functioning, as mentioned above, and the pH probe was not available. The meter records every 0.5 seconds on both the downcast and upcast. It is equipped with a pump to provide for sufficient flushing past the sensors.

The meteorological conditions during sampling was as follows:

- 19 November (AM) - Wind from SE at 10 knots, mostly cloudy to heavy overcast
- 19 November (PM) - Wind from SE at 10 knots, mostly cloudy
- 20 November (AM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy
- 20 November (PM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy

- 21 November (AM) - Wind from S to SE at 5-15 knots, partly cloudy, seas at entrance 6 to 10 feet
- 21 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (AM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 23 November (AM) - Wind calm to 5 knots from N, seas decreased to 3 to 5 feet, partly cloudy
- 23 November (PM) - Same as AM

Station locations are specified in the permit both by latitude and longitude and graphically. The problems with station specification associated with the differences between various map datums and the use of GPS was described in the report on the March 1996 sampling episode. We have recorded, and permanently stored, the WGS 1984 coordinates of the stations actually occupied for the March 1996 sampling and will use the same coordinates for all future sampling episodes. The WGS coordinates occupied, and the times of station occupation, are given in Table 2-1. Figure 2-1 shows the relative locations of the stations occupied for this study.

2.2 DESCRIPTION OF FIELD METHODS

Direct field measurements included water depth, Secchi depth, and DO, in addition pH was measured using subsamples of each grab sample. These measurements were conducted as follows:

- Water depth was measured using a non-recording portable fathometer which was occasionally checked by observing the signal produced as the Secchi disk or the SeaBird were lowered and raised through the water column
- Secchi depth was determined by using a 6" diameter black and white (quartered) Secchi disk lowered through the water column on a measured line
- DO was measured using aliquots of each sample as collected in the field using a YSI Model 50B meter following the manufactures instructions for use of the meter; the meter and probe were field calibrated before and after the sampling
- pH was measured either in the field as samples were collected or using aliquots of grab samples collected for chlorophyll-a analysis using an Orion Model 250A pH meter. These samples are stored on ice and later filtered, a small subsample was used for the pH measurement.

As described above, conductivity, temperature, depth (pressure), and turbidity were measured using an internally recording profiling instrument (SeaBird CDT) which had been calibrated by

the manufacturer prior to shipment to American Samoa. Salinity and sea water density were calculated from conductivity and temperature using the SeaBird supplied software.

Water samples were collected using a Niskin type sampling bottle from each depth specified in the permit (depths of collection at each station are shown in Table 2-1). The collection bottle was lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. A messenger was dropped down the line and the bottle was retrieved after being tripped by the messenger. Sample bottles as described in Table 2-2 were immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory as described in the SAP/SOP (Appendix II). In addition, a minimum of two liters was collected for chlorophyll-a analysis. The chlorophyll samples were later filtered through a Whatman grade GF/F glass fiber filter (0.7 microns) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

2.3 DEVIATIONS FROM THE STUDY PLAN

As in any field data collection, problems and required solutions in the field, interpretation of the guidelines being used, weather, equipment malfunctions, and a variety of other factors may lead to deviations from the study plan. There were only minor deviations during this episode of field data collection which either had no substantial effect on the data recovered and in some cases actually enhanced the objectives of the study. The identified deviations for this study included the following:

- Discrete grab samples for measuring turbidity were collected, in addition to the profile data required by the permit, at selected stations in and around the mixing zone including stations 8, 8A, 14, 15, 16, 17, and 18
- DO was measured for all discrete grab samples for all stations occupied (and data from the continuous profile was discarded)
- pH was measured for all grab samples rather than as a continuous vertical profile
- Extra depths were sampled at Stations 6A and 15 (one additional depth at each station)

Most of the actions listed above were used to verify, and adjust as necessary, data being taken by the vertical profiling (CTD) instrument.

Table 2-1
PAGO PAGO HARBOR WATER QUALITY MONITORING
STATION OCCUPATION SUMMARY
November 1996

Station Number	Sample Collection		CTD Casts [1]		Latitude 14° S [2]	Longitude 170° W [2]	Water Depth [3]	Secchi Depth [4]	Sampling Depths
	Date	Time	Date	Time	(minutes)	(minutes)	(feet)	(feet)	(feet)
TRANSITION ZONE									
5	11/21	09:45	11/23	11:15	17.713	39.733	240	36	S, 30, 60, 90, 120, B
5A	11/21	10:30	11/23	11:25	18.045	40.393	220	33	S, 30, 60, 90, 120, B
OUTER HARBOR									
6	11/22	10:00	11/23	15:00	17.211	40.298	201	25	S, 30, 60, 90, 120, B
6A	11/22	10:30	11/23	15:10	17.316	40.582	102	30	S, 30, 60, B
7	11/21	11:45	11/23	11:05	17.226	39.878	127	23	S, 30, 60, 90, B
8	11/21	15:45	11/23	10:50	16.843	40.098	170	18	S, 30, 60, 90, 120, B
18	11/21	11:15	11/23	11:00	17.092	40.041	192	21	S, 30, 60, 90, 120, B
MIDDLE HARBOR									
8A	11/21	16:15	11/23	10:30	16.826	40.150	173	20	S, 30, 60, 90, 120, B
9	11/20	12:00	11/23	14:30	16.562	40.194	128	31	S, 30, 60, 90, B
9A	11/20	11:00	11/23	14:20	16.293	40.559	130	28	S, 30, 60, 90, B
10	11/20	12:45	11/23	14:40	16.755	40.637	165	23	S, 30, 60, 90, 120, B
10A	11/20	13:30	11/23	14:45	16.997	40.451	123	23	S, 30, 60, 90, B
14	11/21	15:15	11/23	10:35	16.911	40.065	178	20	S, 30, 60, 90, 120, B
15	11/20	16:30	11/23	10:15	16.584	40.116	92	25	S, 30, 60, B
16	11/20	17:15	11/23	14:50	16.891	40.354	193	21	S, 30, 60, 90, 120, B
17	11/22	09:30	11/23	10:45	16.804	40.086	82	28	S, 30, B
INNER HARBOR									
11	11/19	16:30	11/23	11:45	16.480	40.947	164	20	S, 30, 60, 90, 120, B
11A	11/19	16:00	11/23	11:55	16.464	41.151	139	20	S, 30, 60, 90, B
12	11/19	15:30	11/23	12:05	16.449	41.376	64	18	S, 30, B
13	11/19	15:00	11/23	12:10	16.304	41.841	29	15	S, 15, B

Notes:

[1] CDT casts were taken on the day following the final sample collection, and were all done on the same day (23 November 96)

[2] Coordinates are as recorded by GPS using the WGS coordinate system (see text for additional details).

[3] Water depths as recorded on the day of sample collection, correspondence with the day of the CTD casts is typically within a few feet.

[4] (S) = sunny; (Sh) = shadows and/or low sun angle

Table 2-2
PAGO PAGO HARBOR WATER QUALITY MONITORING
SAMPLE ANALYSIS AND HANDLING PROCEDURES
November 1996

PARAMETER	REQUESTED ANALYTICAL METHOD	REQUESTED REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - H_2SO_4
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m^3	3 months	Whatman (0.7 micron) GF/F filter	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper [3]	EPA 220.2	2 µg/l			

Notes:
[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of field team leader.
[2] Holding times for turbidity and nitrite-nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.
[3] Analytical Resources, Inc. tested for copper using method 200.7, following extraction by coprecipitation to achieve the required detection limit.

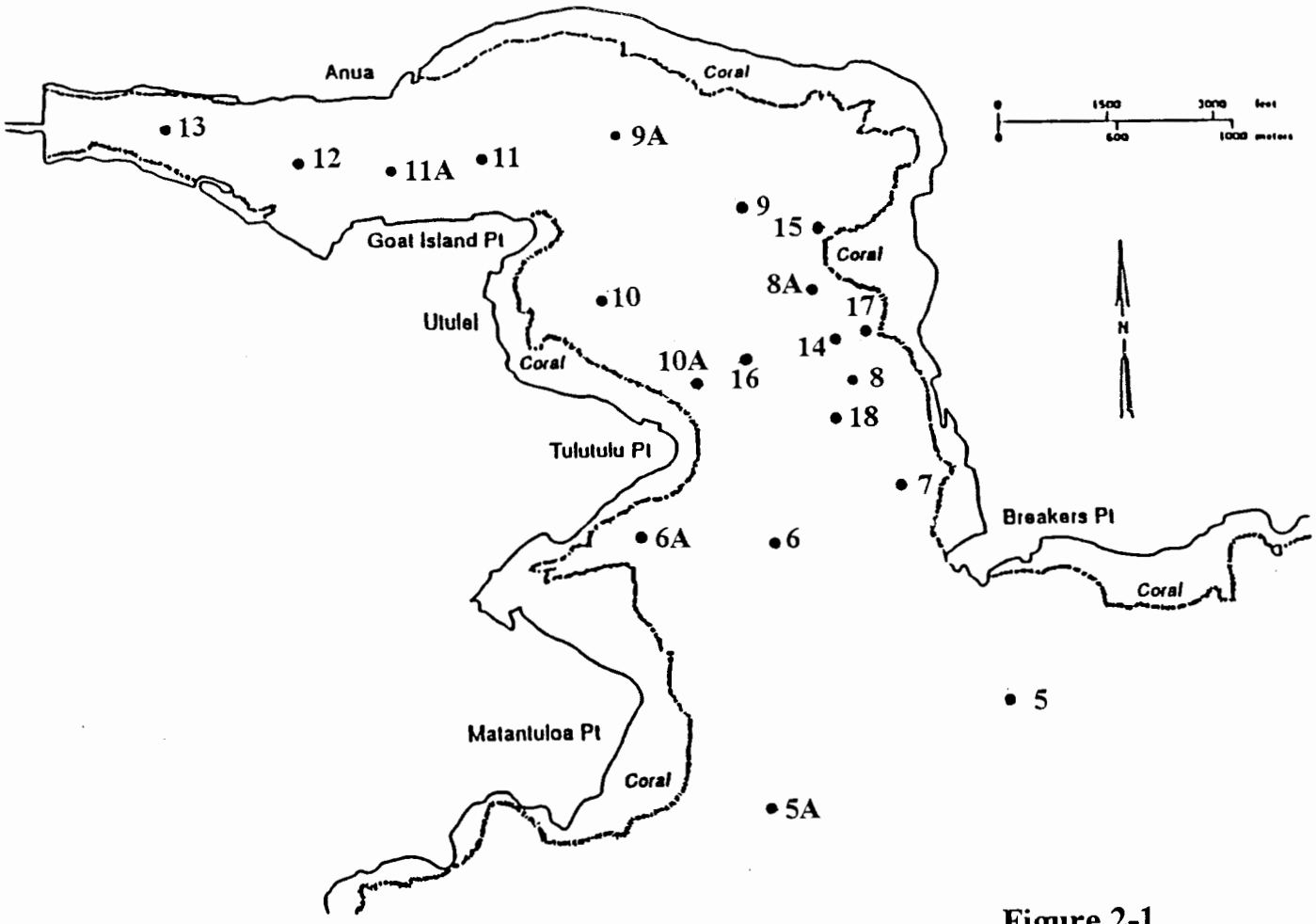


Figure 2-1
Station Locations

3. DATA SUMMARY

It is convenient to categorize the parameters measured in the field and laboratory during this study into three classes: physical and hydrographic parameters that generally describe the water column structure; nutrient and biological parameters that relate more to the health of the harbor; and trace metals. Physical and hydrographic parameters include temperature, salinity, density, DO, pH, turbidity, and Secchi depth, which is used as an indicator of light penetration. Nutrient and biological parameters include the various types of nitrogen, phosphorous, and chlorophyll-a. Zinc and copper were the trace metals of specific interest for this investigation. The results of the November 1996 sampling episode for each of these classes of parameters are presented below.

3.1 PHYSICAL HYDROGRAPHIC PARAMETERS.

The physical and hydrographic parameters measured in the field during the November 1996 harbor monitoring included (in addition to station location and total water depth): temperature, conductivity, dissolved oxygen, pH, turbidity, and light penetration by means of Secchi depth. Temperature, conductivity, and turbidity were measured as continuous vertical profiles. At selected stations turbidity was also measured in the laboratory using the water samples collected as described above. Salinity and density profiles were calculated from the CTD data using the SeaBird software.

Tables 3-1.a through 3-1.d summarize the vertical water column profile data collected with the CTD profiling instrument. The data plots of these hydrographic variables are provided in Appendix III. The Secchi depth measurements are presented in Table 2-1 above. The laboratory analyses for turbidity are given in Table 3-2. The measured values for DO and pH for each station and depth are given in Table 3-3. A brief description of each of the hydrographic parameters of interest parameters is given below.

3.1.1 Temperature

Temperature summaries are given in Table 3-1.a. There was very little variation in temperature throughout the harbor with measured values between 28 and 29.6 °C. Inner harbor temperatures were, at most, a few tenths of a degree warmer than the open ocean. The vertical temperature variations were no more than one degree. There was no identifiable effect of the discharge observable in or around the boundary of the mixing zone.

3.1.2 Salinity

Salinity summaries are provided in Table 3-1.b. As in the case of temperature, there was little or no variability longitudinally. In general there is little stratification with vertical variations typically less than 1 ppt. There is no discernible influence from the JCO discharge.

3.1.3 Density

Density (Table 3-1.c), in terms of σ_t, is summarized in Table 3-1.c. The water column is very well mixed with little indication of a strong density gradients. Vertical variations between surface and bottom were typically seen to be about 0.5 sigma-t units (1 unit is equivalent to 0.001 $g/^{cm3}$), at the harbor mouth, less than 1 unit in the outer harbor, and up to 1 unit in the inner harbor. There is little longitudinal variation and no discernible influence from the JCO discharge.

3.1.4 Turbidity

Turbidity was measured throughout the water column using a SeaPoint optical sensor mounted on the SeaBird CTD. The turbidity sensor was set for the highest resolution and lowest range and threshold possible. Even at these settings, the minimum reading of the instrument was approximately 0.13 NTU and the resolution was 0.01 NTU. That means any value lower than 0.13, even a value of zero, was recorded as 0.13 NTU. Conversations with the manufacturers of both the turbidity meter and the CTD on which it was mounted indicate the a portion of the 0.13 NTU lowest reading is an instrument offset and can be subtracted from the actual reading. However, this value is not easily determined and appropriate tests were not done to define this value in the field. Therefore, the data including the small offset is presented in this report. It is recognized that all values are reported slightly higher than they should be and the instrument detection limit is lower than 0.13 NTU.

The data from the turbidity profiles is summarized for each station in Table 3-1.d. A higher turbidity layer was often observed near bottom. The average values throughout the water column are low, generally less than 1 NTU. The ASWQS for turbidity is 0.75 NTU (median value). The median value for the continuous profiles at each station was not calculated but can be approximated from the plots in Appendix III. Compliance with the ASWQS is achieved based on the profile data. Because of the instrument characteristics, the potential problem of a undefined offset was recognized in the field and turbidity analysis was requested on selected samples in and around the mixing zone. Samples from the all stations within the mixing zone and on the mixing zone boundary were sampled for turbidity analysis. The data are given in Table 3-2 and indicate compliance with ASWQS.

3.1.5 Dissolved Oxygen

There is both vertical and longitudinal spatial variability and temporal variability of DO indicated in the data provided in Table 3-3, as was expected. There is, however, no indication of a reduction of DO in the mixing zone. There is sufficient temporal variability, depending on time of day the measurement was taken, to mask any overall trends in longitudinal spatial variation. This is consistent with the higher chlorophyll-a values than previously measured in March of 1996, and March 1995. There is a distinct vertical trend with higher values usually found near the surface. A subsurface depression is seen at some of the stations.

The measured DO was above the numerical American Samoa water quality standard (ASWQS) on a water column average basis at every station and on a point-by point basis at over 85 percent of the points sampled. [The ASWQS is that DO shall be "*Not less than 70 percent of saturation or less than 5.0 mg/l. If the natural level of dissolved oxygen is less than 5.0 mg/l, the natural level will become the standard.*"] The data available is insufficient to determine if those observed values below 5.0 are "natural" or result from the effluent discharge. However, the pattern observed indicates high productivity may be a primary factor resulting in depressed DO levels at depth. The ASWQS specifies an (undefined) average value of 5 mg/l as that needed for compliance. It is noted that any type of reasonable average for the data recovered will result in compliance.

3.1.6 pH Measurements

Table 3-3 summarizes the pH readings obtained during the study. There are small differences observed along the harbor axis, but no distinct trends. Surface values are slightly lower than those at depth. No effect of the discharge can be observed.

Measured pH values appear to meet the ASWQS numerical standard at all locations. [The ASWQS is the "*The pH range shall be 6.5 to 8.6 and be within 0.2 pH unit of that which would occur naturally.*"] The natural value for marine waters is generally considered to be in the range of 7.5 to 8.4. For near surface waters (water in equilibrium with atmospheric CO_2), pH is typically about 8.1 to 8.2. Variability in coastal waters will be more extreme and freshwater inflows will tend to depress the natural values.

During the study, it was observed that the pH values being recorded by the profiling instrument appeared consistently lower than expected. Calibration of the instrument in the field was considered but determined to be not feasible. Therefore, pH of surface samples was measured with a calibrated pH meter and compared to the readings at the surface from the profiling instrument and a correction was developed and applied to the profile data. The details of this process are provided in Appendix IV.

3.1.7 Secchi Depth

Secchi depths are presented in Table 2-1 above. The values recorded show a trend, increasing from the inner harbor to the outer harbor as would be expected. This trend is somewhat confused by the differences in time of day, and thus sun angle and diurnal variations in water clarity. In addition, it must be noted, the times of data collection were almost entirely during complete or nearly complete overcast sky conditions and thus Secchi depths will be substantially understated compared to those collected under standard clear sky conditions. The Secchi depths observed in the inner harbor range from 15 to 20 feet. The Secchi depth was 15 feet at Station 13 which is the inner most station, in a total water depth of about 29 feet.

The ASWQS is in terms of light penetration, which cannot be directly converted from Secchi or turbidity readings. However, some estimates can be made with light penetration being estimated by Secchi depth using the following approximation:

$$\chi = \kappa \cdot D^{-1}$$

where

χ = extinction coefficient for visible light

κ = a constant

and

D = Secchi depth in meters for a 30 cm Secchi disk.

The constant κ is not easily determined but is often taken as 1.7 based on data from the English Channel (Sverdrup, 1942). Using the above approximation, the depth of light penetration of 1 percent corresponds to a Secchi depth of 24 feet. Such a calculation corresponds to Secchi readings taken at high sun angles and in full sun light. As pointed out above, this was not possible during times of data collection in November 1996. The corresponding depth under conditions during measurements at this time is likely less than half that calculated above, based on a review of previous data.

The ASWQS state that light penetration of 1 percent of the incident light should penetrate to a depth of 65 feet 50 percent of the time. As calculated above this corresponds to Secchi depth of approximately 24 feet (under appropriate conditions). The data can not be directly used to evaluate compliance in this case, however expedience and judgment would indicate that ASWQS for light penetration are being satisfied throughout the harbor.

3.2 NUTRIENT AND BIOLOGICAL PARAMETERS

Parameters to evaluate potential impacts of biological productivity included nutrients and chlorophyll-a. Nutrients included total phosphorus, total Kheldal nitrogen (TKN), ammonia nitrogen, nitrate plus nitrite, and nitrite nitrogen. ASWQS apply to total nitrogen (TN) which was calculated by adding the nitrogen components, noting that ammonia is included in TKN. Table 2-2 above indicates the nutrient constituents measured and the methods used in the laboratory. Samples were prepared for chlorophyll-a analysis by filtering 2 liters of water through a filter (see Table 2.2) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

The laboratory used for the analyses was AMTEST, located in Redmond, WA. Samples were stored on ice in American Samoa and shipped on ice via DHL to the laboratory. Laboratory chain of custody forms and results are provided in Appendices IV and V, respectively. Each of the nutrient and parameters are discussed below based on the data summarized in Table 3-4.

3.2.1 Total Nitrogen

The numerical standard (median value) for total nitrogen (TN) is 200 µg/l. Of the 100 measurements 1 was above this value. A TN of approximately 266 was recorded at Station 11A in the inner harbor at a depth of 30 feet. The next highest value was 178 at station 8A at a depth of 60 feet, which is inside the mixing zone. The ASWQS for TN is met throughout the harbor at the time of sampling.

3.2.2 Total Phosphorus

The numerical standard for total phosphorus (median value) is 30 µg/l. As shown in Table 3-4, a total 4 of the 100 measurements were above this value. At Station 9 there were two measurements reported at 31 µg/l at depths of 30 and 60 feet (a concentration of 30 µg/l was reported at 90 feet). The median value at this station was 30 µg/l. At station 8A TP concentrations of 62 and 65 µg/l were reported at 30 and 60 feet, respectively. Station 8A is within the mixing zone and the median value at this station was between 17 and 23 µg/l. The ASWQS for TP is met throughout the harbor at the time of sampling.

3.2.3 Chlorophyll-a

The numerical standard (median) for chlorophyll-a is 1 µg/l. Fourteen (14) of the 20 stations exhibited chlorophyll-a values higher than 1.0 µg/l. In every case the higher values were in the upper portion of the water column, typically at the near surface and 30 foot depths (see Table 3-4). At 9 of the 14 stations the median at was at or below the ASWQS of 1.0 µg/l. Of the remaining stations two (12 and 13) are in the inner harbor which typically has higher levels, only one is on the mixing zone boundary (17), and two are in the outer harbor (6A and 7). The median value for the harbor was less than 1.0 µg/l and the median value for each station was below 1.0 µg/l except as noted above.

It appears that many of the elevated values could be attributable to runoff through Pago Pago Creek, and other streams around the harbor. Examination of the other water column constituents provides no evidence that the elevated values of chlorophyll-a are attributable to the JCO discharge. Overall, regardless of the higher values in certain locations, the ASWQS appear to be met throughout the harbor with the possible exception of the far inner harbor, which is attributable to causes other than the JCO discharge as mentioned above, and a small portion of the outer harbor, not within the mixing zone.

3.3 Zinc and Copper Concentrations

Zinc and copper were measured at specified stations and depths. Samples were collected and preserved as described above and in the SAP/SOP (Appendix II). Table 3-5 summarizes the results of the metals analyses. The chain of custody forms and laboratory results are provided in Appendices IV and VI, respectively. All analyses resulted in reported values less than detection limits. The reason for conducting these analyses is to provide receiving water data

for the assessment of a mixing zone for these two metals. The data for both zinc and copper were adequate for this purpose with values of <20 µg/l and < 2 µg/l as requested and well below the water quality criteria.

Table 3-1.a
Summary of Temperature Measurements (°C)
from Continuous Vertical Profiles
Pago Pago Harbor Water Quality Modeling
23 November 1996

Station	Maximum	Minimum	Average	Standard Deviation
Transition Zone				
5	28.63	27.97	28.21	0.18
5A	28.88	28.18	28.30	0.16
Outer Harbor				
6	29.06	27.87	28.19	0.26
6A	29.48	28.21	28.39	0.22
7	29.04	28.03	28.31	0.22
Mixing Zone - Interior				
8	28.55	28.03	28.31	0.15
8A	28.52	28.00	28.25	0.16
14	28.53	28.00	28.28	0.16
Mixing Zone - Edge				
15	28.49	28.17	28.32	0.09
16	29.19	27.99	28.26	0.23
17	28.68	28.13	28.36	0.12
18	28.62	28.01	28.24	0.16
Middle Harbor				
9	29.26	28.14	28.38	0.23
9A	29.34	28.24	28.42	0.23
10	29.31	28.01	28.33	0.30
10A	28.95	28.19	28.36	0.20
Inner Harbor				
11	29.05	28.02	28.31	0.19
11A	29.04	28.05	28.36	0.24
12	29.10	28.07	28.31	0.23
13	29.56	28.39	28.65	0.32

Table 3-1.b
Summary of Salinity Measurements (PSU)
from Continuous Vertical Profiles
Pago Pago Harbor Water Quality Modeling
23 November 1996

Station	Maximum	Minimum	Average	Standard Deviation
Transition Zone				
5	35.70	35.36	35.63	0.05
5A	35.66	35.20	35.60	0.08
Outer Harbor				
6	35.73	35.02	35.62	0.13
6A	35.64	35.26	35.60	0.08
7	35.68	34.52	35.52	0.23
Mixing Zone - Interior				
8	35.67	34.83	35.56	0.14
8A	35.66	34.75	35.59	0.11
14	35.66	34.80	35.58	0.12
Mixing Zone - Edge				
15	35.64	34.35	35.56	0.21
16	35.73	34.99	35.61	0.12
17	35.64	35.25	35.57	0.08
18	35.67	34.65	35.57	0.17
Middle Harbor				
9	35.62	34.69	35.53	0.17
9A	35.64	34.94	35.54	0.15
10	35.68	35.03	35.58	0.14
10A	35.64	35.10	35.55	0.11
Inner Harbor				
11	35.65	34.67	35.56	0.13
11A	35.66	34.71	35.50	0.21
12	35.60	34.66	35.51	0.13
13	35.53	34.42	35.35	0.23

Table 3-1.c
Summary of Sigma-t Measurements
from Continuous Vertical Profiles
Pago Pago Harbor Water Quality Modeling
23 November 1996

Station	Maximum	Minimum	Average	Standard Deviation
Transition Zone				
5	22.93	22.46	22.80	0.10
5A	22.84	22.26	22.75	0.11
Outer Harbor				
6	22.97	22.07	22.80	0.18
6A	22.81	22.14	22.72	0.13
7	22.90	21.72	22.69	0.24
Mixing Zone - Interior				
8	22.87	22.10	22.72	0.14
8A	22.89	22.05	22.76	0.12
14	22.90	22.09	22.74	0.13
Mixing Zone - Edge				
15	22.82	21.77	22.71	0.18
16	22.94	21.99	22.77	0.17
17	22.83	22.37	22.71	0.09
18	22.89	21.93	22.75	0.17
Middle Harbor				
9	22.80	21.74	22.67	0.20
9A	22.80	21.91	22.66	0.19
10	22.91	22.00	22.72	0.21
10A	22.82	22.16	22.69	0.15
Inner Harbor				
11	22.88	21.80	22.72	0.16
11A	22.84	21.83	22.65	0.23
12	22.81	21.83	22.65	0.23
13	22.67	21.44	22.45	0.28

Table 3-1.d Summary of Turbidity Measurements (NTU) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 23 November 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	1.07	0.12	0.37	0.20
5A	0.65	0.13	0.22	0.11
Outer Harbor				
6	0.93	0.15	0.42	0.20
6A	1.42	0.27	0.51	0.24
7	1.72	0.39	0.75	0.35
Mixing Zone - Interior				
8	4.74	0.18	0.73	0.53
8A	14.04	0.38	1.75	2.74
14	3.49	0.23	0.96	0.77
Mixing Zone - Edge				
15	6.29	0.38	1.03	0.55
16	3.40	0.16	0.64	0.55
17	2.08	0.42	0.84	0.27
18	5.17	0.20	0.94	0.72
Middle Harbor				
9	1.60	0.38	0.81	0.31
9A	2.80	0.34	0.78	0.31
10	6.23	0.31	0.64	0.48
10A	1.73	0.32	0.50	0.15
Inner Harbor				
11	2.74	0.25	0.83	0.52
11A	3.17	0.43	0.99	0.65
12	2.42	0.64	1.21	0.47
13	9.48	0.92	1.86	1.07

Table 3-2
Results of Laboratory Analyses of Turbidity for Selected Stations
Pago Pago Harbor Water Quality Monitoring
November 1996

	Turbidity at Station Depths Indicated (NTU)							
Depth (feet)[1]	**S**	**30**	**60**	**90**	**120**	**B**	**Average**	**Median**
Stations								
Mixing Zone Interior								
8	0.10	0.09	0.05	0.01	<0.01	<0.01	0.05	0.01 - 0.05
8A	0.11	0.24	0.27	0.03	<0.01	0.07	0.12	0.07 - 0.11
14	0.14	0.15	0.07	0.04	0.05	0.11	0.09	0.07 - 0.11
ZOM Boundary								
15[2]	0.20	0.09	0.03	-	-	0.06	0.10	0.06 - 0.09
16	0.18	0.11	0.12	0.08	0.16	0.20	0.14	0.12 - 0.16
17[3]	0.19	0.22	-	-	-	0.21	0.21	0.21
18	0.13	0.43	0.14	0.08	0.08	0.13	0.17	0.13 - 0.14

Notes:
[1] S = Near Surface (within 1 meter of the surface); B= Near Bottom (within 1 meter of the bottom)
[2] Station 15 sampled at only four depths as shown
[3] Stations 17 sampled at only three depths as shown.

Table 3-3
Dissolved Oxygen and pH measurements
Pago Pago Harbor Water Quality Monitoring - November 1996

Station	Depth	DO (mg/l)	pH (SU)[1]	Station	Depth	DO (mg/l)	pH (SU)[1]
5	SURF	5.5	***8.36***	10A	SURF	5.8	8.35
	30	5.6	***8.28***		30	5.3	8.35
	60	5.7	***8.34***		60	5.3	8.35
	90	5.8	***8.30***		90	5.2	8.35
	120	5.9	***8.29***		BOTM	5.2	8.35
	BOTM	5.9	***8.28***				
5A	SURF	5.6	***8.26***	11	SURF	7.9	8.37
	30	5.6	***8.36***		30	7.4	8.36
	60	5.6	***8.33***		60	7.0	8.35
	90	5.4	***8.32***		90	7.2	8.36
	120	5.5	***8.29***		120	6.8	8.35
	BOTM	5.4	***8.23***		BOTM	6.4	8.35
6	SURF	5.0	***8.38***	11A	SURF	7.7	8.37
	30	5.1	***8.41***		30	7.4	8.35
	60	5.0	***8.42***		60	6.8	8.34
	90	4.9	***8.40***		90	7.0	8.34
	120	4.8	***8.45***		BOTM	6.5	8.34
	BOTM	4.7	***8.45***				
6A	SURF	5.1	***8.43***	12	SURF	7.7	8.35
	30	5.1	***8.38***		30	6.8	8.32
	60	5.1	***8.38***		BOTM	6.6	8.32
	BOTM	5.0	***8.41***				
7	SURF	5.1	***8.36***	13	SURF	7.9	8.35
	30	4.6	***8.34***		15	7.1	8.30
	60	5.1	***8.32***		BOTM	6.4	8.21
	90	5.2	***8.28***				
	BOTM	5.2	***8.38***				
8	SURF	5.4	***8.42***	14	SURF	5.4	***8.44***
	30	5.1	***8.44***		30	5.1	***8.43***
	60	5.0	***8.36***		60	4.6	***8.40***
	90	4.9	***8.37***		90	4.8	***8.42***
	120	4.9	***8.41***		120	5.0	***8.39***
	BOTM	5.1	***8.39***		BOTM	4.6	***8.35***
8A	SURF	5.4	***8.39***	15	SURF	5.3	8.22/***8.07***
	30	5.1	***8.37***		30	5.1	8.27/***8.29***
	60	5.0	***8.32***		60	5.0	8.29/***8.28***
	90	5.1	***8.37***		BOTM	4.8	8.28/***8.09***
	120	4.9	***8.36***				
	BOTM	4.8	***8.35***				
9	SURF	6.1	8.33	16	SURF	5.6	8.34/***8.38***
	30	4.9	8.30		30	5.3	8.28/***8.41***
	60	5.0	8.28		60	5.2	8.27/***8.41***
	90	4.6	8.28		90	5.3	8.30/***8.20***
	BOTM	5.1	8.30		120	5.5	8.31/***8.43***
					BOTM	4.6	8.30/***8.21***
9A	SURF	6.0	8.30	17	SURF	4.9	***8.43***
	30	6.5	8.29		30	5.0	***8.48***
	60	6.0	8.28		BOTM	4.3	***8.36***
	90	5.9	8.26				
	BOTM	6.2	8.18				
10	SURF	6.0	8.30	18	SURF	5.3	***8.31***
	30	5.9	8.32		30	5.1	***8.35***
	60	5.9	8.32		60	5.1	***8.34***
	90	5.8	8.34		90	5.1	***8.37***
	120	5.4	8.34		120	5.1	***8.36***
	BOTM	5.4	8.35		BOTM	4.9	***8.34***

[1] pH values shown in ***bold italic*** were measured in chlorophyll-a samples during filtering, others were measured in the field as samples were collected.

Table 3-4
Nutrients and Chlorophyll-a Measurements
Pago Pago Harbor Water Quality Monitoring
November 1996

Station	Depth	Chlorophyll-a (mg/m^3)	Ammonia Nitrogen (mg/l)	TKN (mg/l)	Nitrate + Nitrite (mg/l)	Nitrite Nitrogen (mg/l)	Total Phosphorus (mg/l)
5	SURF	0.25	<0.005	0.028	<0.01	<0.001	0.009
5	30	0.22	<0.005	<0.025	<0.01	<0.001	0.009
5	60	0.48	<0.005	0.049	<0.01	<0.001	0.014
5	90	0.59	<0.005	0.066	<0.01	<0.001	<0.005
5	120	0.12	<0.005	0.092	<0.01	0.002	0.011
5	BOTM	0.12	<0.005	0.028	<0.01	0.009	0.013
5A	SURF	0.34	<0.005	0.071	<0.01	<0.001	0.005
5A	30	0.59	<0.005	0.060	<0.01	<0.001	0.013
5A	60	0.71	<0.005	0.093	<0.01	<0.001	0.012
5A	90	0.49	<0.005	0.043	<0.01	<0.001	0.011
5A	120	0.47	<0.005	<0.025	<0.01	<0.001	0.009
5A	BOTM	0.36	<0.005	<0.025	<0.01	0.009	0.010
6	SURF	1.8	<0.005	0.063	<0.01	0.001	0.008
6	30	2.0	<0.005	0.097	<0.01	0.001	0.016
6	60	0.96	<0.005	0.029	<0.01	0.002	0.009
6	90	0.57	<0.005	<0.025	<0.01	0.005	0.014
6	120	0.34	<0.005	0.039	<0.01	0.010	0.007
6	BOTM	0.48	<0.005	0.047	<0.01	0.009	0.010
6A	SURF	1.3	<0.005	0.039	<0.01	<0.001	0.009
6A	30	1.6	<0.005	0.10	<0.01	<0.001	0.009
6A	60	1.5	<0.005	0.068	<0.01	<0.001	0.012
6A	BOTM	0.78	<0.005	<0.025	<0.01	<0.001	0.009
7	SURF	1.6	<0.005	<0.025	<0.01	<0.001	0.019
7	30	1.3	0.005	0.035	0.012	0.012	0.020
7	60	1.1	<0.005	0.028	<0.01	0.005	0.016
7	90	1.3	<0.005	0.12	<0.01	0.003	0.016
7	BOTM	0.61	<0.005	0.051	<0.01	0.003	0.024
8	SURF	2.0	<0.005	<0.025	<0.01	<0.001	0.014
8	30	2.7	<0.005	<0.025	<0.01	0.001	<0.005
8	60	0.85	0.006	0.040	<0.01	0.011	0.027
8	90	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8	120	0.36	<0.005	<0.025	<0.01	0.003	0.022
8	BOTM	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8A	SURF	1.2	<0.005	0.031	<0.01	<0.001	0.023
8A	30	1.9	0.10	0.15	<0.01	0.006	0.062
8A	60	0.96	0.10	0.17	<0.01	0.008	0.065
8A	90	0.60	<0.005	<0.025	<0.01	0.003	0.017
8A	120	0.35	<0.005	<0.025	<0.01	0.004	0.016
8A	BOTM	0.24	<0.005	<0.025	0.014	0.022	0.013
9	SURF	0.35	<0.005	<0.025	<0.01	0.017	0.022
9	30	0.53	0.009	0.047	<0.01	<0.001	0.031
9	60	0.37	0.01	<0.025	0.022	0.030	0.031
9	90	0.36	0.008	0.056	0.031	0.029	0.030
9	BOTM	0.34	<0.005	<0.025	0.013	0.016	0.024
9A	SURF	0.82	<0.005	<0.025	<0.01	0.001	0.018
9A	30	0.80	<0.005	<0.025	<0.01	0.018	0.022
9A	60	0.37	<0.005	<0.025	<0.01	0.027	0.026
9A	90	0.34	<0.005	<0.025	0.016	0.005	0.019
9A	BOTM	0.31	<0.005	<0.025	<0.01	0.002	0.019

Table 3-4 - continued							
Station	**Depth**	**Chlorophyll-a (mg/m^3)**	**Ammonia Nitrogen (mg/l)**	**TKN (mg/l)**	**Nitrate + Nitrite (mg/l)**	**Nitrite Nitrogen (mg/l)**	**Total Phosphorus (mg/l)**
10	SURF	0.74	<0.005	<0.025	<0.01	<0.001	0.013
10	30	0.69	<0.005	0.030	<0.01	0.007	0.019
10	60	0.47	<0.005	0.062	<0.01	0.009	0.012
10	90	0.48	<0.005	0.030	<0.01	0.004	0.012
10	120	0.59	<0.005	<0.025	<0.01	0.014	0.014
10	BOTM	0.49	<0.005	<0.025	<0.01	<0.001	0.014
10A	SURF	0.36	<0.005	<0.025	<0.01	0.002	0.014
10A	30	0.69	<0.005	<0.025	<0.01	0.007	0.018
10A	60	0.47	<0.005	<0.025	<0.01	0.003	0.011
10A	90	0.61	<0.005	<0.025	<0.01	0.007	0.012
10A	BOTM	0.50	<0.005	<0.025	<0.01	0.007	0.014
11	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.014
11	30	1.1	<0.005	<0.025	<0.01	0.006	0.011
11	60	0.98	<0.005	<0.025	0.011	0.021	0.012
11	90	0.43	<0.005	0.029	<0.01	0.008	<0.005
11	120	0.29	<0.005	<0.025	<0.01	0.024	<0.005
11	BOTM	0.41	<0.005	<0.025	0.014	0.026	0.019
11A	SURF	1.7	<0.005	<0.025	<0.01	0.002	<0.005
11A	30	1.4	<0.005	0.26	<0.01	0.006	<0.005
11A	60	0.60	<0.005	0.13	0.019	0.023	0.011
11A	90	0.61	<0.005	0.049	<0.01	0.011	0.011
11A	BOTM	0.24	<0.005	0.037	0.018	0.027	0.016
12	SURF	1.9	<0.005	0.050	<0.01	0.003	0.010
12	30	1.0	<0.005	0.034	0.011	0.013	0.018
12	BOTM	0.35	<0.005	0.056	0.027	0.033	0.010
13	SURF	3.7	<0.005	0.070	0.024	0.002	0.025
13	15	1.4	<0.005	<0.025	<0.01	0.005	0.014
13	BOTM	1.2	<0.005	<0.025	<0.01	0.013	0.016
14	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.009
14	30	2.6	<0.005	<0.025	<0.01	0.004	<0.005
14	60	0.48	0.016	0.042	0.011	0.013	0.017
14	90	0.60	<0.005	<0.025	<0.01	0.006	<0.005
14	120	0.12	<0.005	<0.025	<0.01	0.013	<0.005
14	BOTM	0.12	<0.005	0.038	<0.01	0.021	0.021
15	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.016
15	30	1.2	<0.005	<0.025	<0.01	0.009	0.018
15	60	0.84	<0.005	<0.025	<0.01	0.013	0.014
15	BOTM	0.49	0.015	0.031	0.029	0.028	0.020
16	SURF	1.4	<0.005	<0.025	<0.01	0.002	0.017
16	30	1.6	<0.005	<0.025	<0.01	0.003	<0.005
16	60	0.24	<0.005	0.033	<0.01	0.004	0.009
16	90	0.48	<0.005	<0.025	<0.01	0.001	<0.005
16	120	1.2	<0.005	<0.025	<0.01	<0.001	0.011
16	BOTM	0.12	<0.005	<0.025	0.017	0.028	0.018
17	SURF	1.1	<0.005	<0.025	<0.01	<0.001	0.013
17	30	2.0	<0.005	<0.025	<0.01	<0.001	0.018
17	BOTM	0.74	0.044	0.12	<0.01	0.012	0.048
18	SURF	1.7	<0.005	<0.025	<0.01	<0.001	0.010
18	30	1.5	0.009	0.049	<0.01	0.010	0.020
18	60	1.3	<0.005	<0.025	<0.01	0.006	0.019
18	90	0.73	<0.005	<0.025	<0.01	0.004	0.018
18	120	0.48	<0.005	<0.025	<0.01	0.010	0.026
18	BOTM	0.24	<0.005	<0.025	0.012	0.022	0.015

Table 3-5
Zinc and Copper Analysis Results
Pago Pago Harbor Water Quality Monitoring
November 1996

Station	Depth	Zinc Concentration (µg/l)	Copper Concentration (µg/l)
Transition Zone			
5	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
5A	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
Inner Harbor			
11	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
13	Near Surface	<20	<2
	Near Bottom	<20	<2
ZOM Boundary			
15	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
16	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
18	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2

4. CONCLUSIONS AND RECOMMENDATIONS

The second semiannual Receiving Water Quality Monitoring study was successfully completed with only minor deviations from the SAP/SOP. The data indicate compliance with ASWQS throughout the harbor. The water quality standards are based on median values of many constituent concentrations, and the standards were fully achieved on this basis. The numerical criteria, on which the standards are based, are occasionally exceeded at individual stations (although this does not necessarily mean water quality standards are violated). However, in no instance outside the mixing zone, can the individual excursions above the criteria be attributed to the JCO discharge. The canneries are in compliance with the applicable conditions of the NPDES permits.

Other than specific points described in the report, no general recommendations are made for conducting future sampling episodes of water quality monitoring. Summarizing specific points for detailed field and laboratory work the following recommendation is made, and will be followed in the future:

> The turbidity sensor should be more rigorously tested, if possible to determining the actual instrument offset and resolution for reasons described in Section 3. Until we are confident of the performance of the sensor, supplementary samples should continue to be designated for turbidity testing in the laboratory. Locations should be at the mixing zone boundary (Stations 15,16,17, and 18) and background (Stations 5 and 5A). Concurrent with the "dock side" verification testing for other profiling instruments, the readings from the turbidity sensor should be examined before and after the sampling and profiling.

5. REFERENCES

CH2M HILL, 1991. Engineering and Environmental Feasibility Evaluation of Waste Disposal Alternatives. Prepared for StarKist Samoa, Final Report, March 1991.

CH2M HILL and Glatzel and Associates, 1995. Results of March 1995 Harbor Water Quality Monitoring, Pago Pago American Samoa.

CH2M HILL and **gdc**, 1997. Receiving Water Quality Monitoring Report: Pago Pago Harbor, American Samoa: March 1996 Sampling. 6 March 1996.

D&A Instrument Company, 1991. Instruction manual: OBS-1 & 3 Suspended Solids & Turbidity Monitor. Port Townsend, WA Revised March 1991.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000019, Issued to StarKist Samoa, Inc., 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000027, Issued to VCS Samoa packing Company, 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Modification of Receiving Water Qaulity Monitoring Requirements of NPDES Permit AS000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company. November 8, 1995.

Sea-Bird Electronics, Inc., 1993. CDT Data Acquisition Software: SEASOFT, Version 4.026. Bellevue, WA, May 1993.

Sverdrup, H.U. et al., 1942. The Oceans. Prentice-hall, Englewood Cliffs NJ.

Appendix I

USEPA Permit Modification for Receiving Water Quality Monitoring

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

NOV 0 8 1995

Norman Wei
Corporate Environmental Manager
StarKist Foods, Inc.
1054 Ways Street
Terminal Island, CA 90731

James L. Cox
Director of Engineering
and Environmental Affairs
Van Camp Seafood Company, Inc.
4510 Executive Drive, Suite 300
San Diego, CA 92121-3029

Subject: Modification of Receiving Water Quality Monitoring Requirements of NPDES Permit AS0000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company

Dear Mr. Wei and Mr. Cox:

The U.S. Environmental Protection Agency (EPA) Region IX is modifying the receiving water quality monitoring program for the above-referenced National Pollutant Discharge Elimination System (NPDES) Permits AS0000019 and AS0000027, as per 40 CFR 122, effective November 10, 1995. Based on review of the water quality data collected under this permit, it appears that the American Samoa water quality standards for constituents monitored under the NPDES permits for the canneries are generally being met throughout Pago Pago Harbor, except in the inner harbor and ocassionally in the zone of mixing for the joint cannery outfall. It is surmised that the inner harbor exceedances may not be attributable to the canneries' discharge and the revised monitoring program will provide data to better define the causes for any noncompliance with water quality standards.

This modification to the receiving water quality monitoring program is considered a minor modification as the overall monitoring effort required is not being reduced. The purpose of the original monthly monitoring program was to assess the short-term effects of the canneries' discharge at the new outfall location. Over the past three years, sufficient data has been collected and reviewed for this purpose. The monitoring program is now being revised to assess the long-term effects of the discharge to the harbor. Changes are being made in monitoring frequency (from monthly to semi-annually to cover both oceanographic seasons), and in sampling types (from grab to continuous vertical profiles) for some parameters. Three new sampling stations are being re-

quired as well as monitoring for two additional parameters (zinc and copper) at certain stations.

Additional sampling for zinc and copper is being required to establish ambient background levels in the harbor which will be used to determine the applicability of establishing mixing zones for these constituents. Elevated zinc and copper effluent levels have been noted and significant reductions in source loadings would be very difficult, for reasons cited in the "Metals Source Identification Study for Samoa Packing", dated June 15, 1995.

The changes to the receiving water monitoring program are detailed in the attached pages. (Shaded text indicates additions to the permit. Lined out items are deletions.) These replace the corresponding pages in the permit and are hereby incorporated into and made a part of both Permits AS0000019 and AS0000027. In summary, the changes are as follows:

1. The frequency of sampling is reduced from monthly to semi-annually (corresponding with other sampling events required by the permit: effluent priority pollutant, toxicity and sediment monitoring);

2. The number of sampling stations is increased by three, from 17 to 20, and will be located as follows: on the western side of the middle harbor (American Samoa Power Authority Station B), outer harbor (new Station 6A), and transition zone (new Station 5A).

3. Continuous vertical profiles will be performed, rather than discrete samples, for temperature, salinity (conductivity), dissolved oxygen, pH, and turbidity.

4. Six, rather than three samples will be taken per station where possible, for nutrients and chlorophyll-a. Three samples will be taken at depths currently specified (near surface, 60 feet and near bottom), and three additional samples will be taken at 30, 90 and 120 feet. A minimum of three samples will be taken at each station (near surface, mid-depth and near bottom).

5. Suspended solids is removed from the suite of constituents to be analyzed.

6. Sampling for zinc and copper will be required and conducted at the same frequency as for the revised water quality monitoring program (approximately every six months). Sampling locations will be at the boundary of the existing mixing zone established for total nitrogen and total phosphorus, in the transition zone and in the inner harbor. Stations and depths to be sampled are as follows:

Stations	Depths
15, 16, 18, 5, 5A	30 ft., 120 ft., near bottom
11, 13	near surface, near bottom

The number of stations and samples may be adjusted based on the results of the first sampling episode.

7. A standard operating procedure and study plan for the revised water quality monitoring program will be developed and submitted within 30 days of the effective date of this revision for approval.

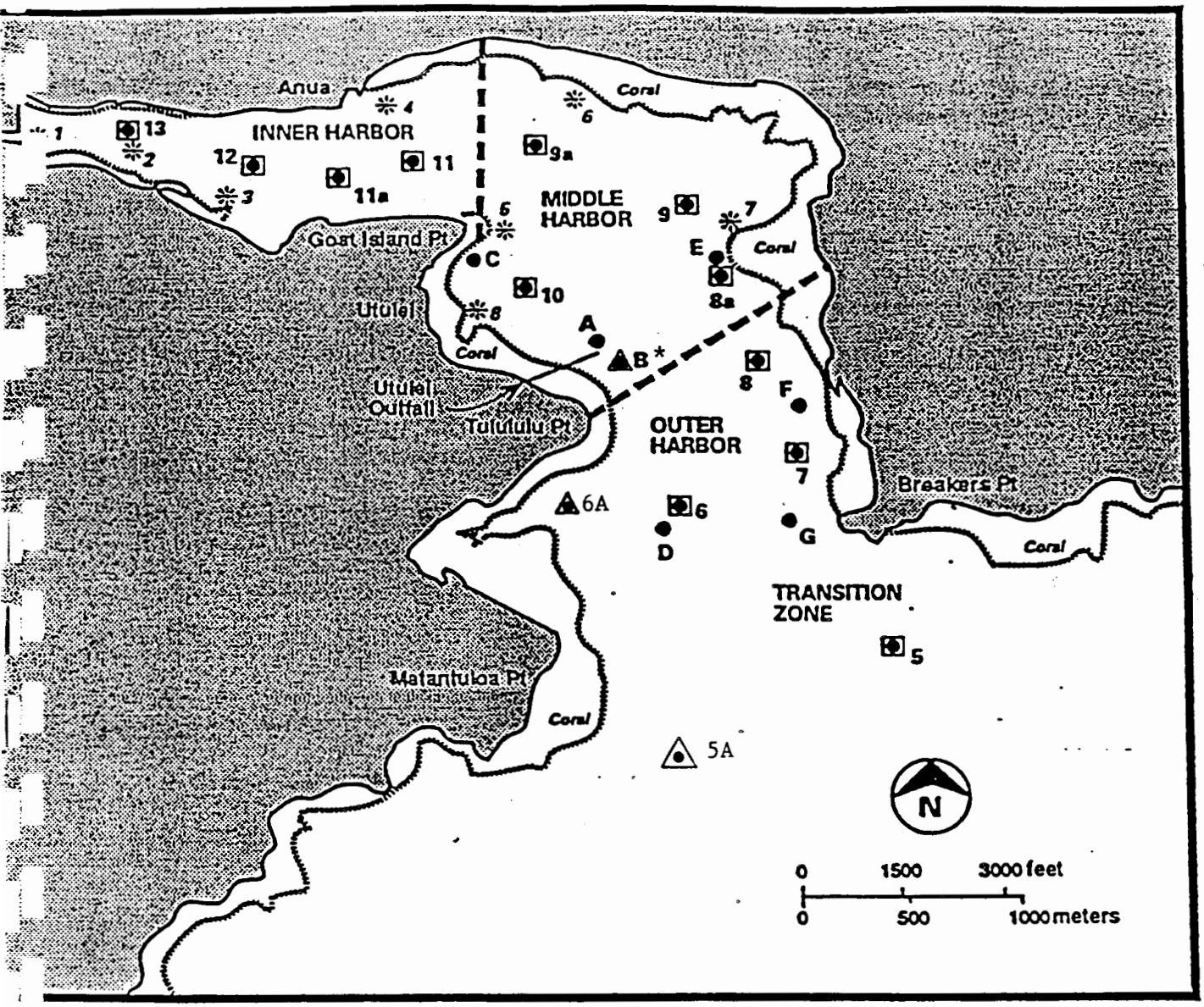
A copy of this letter and the revised pages of the permit should be attached to the current NPDES permit and kept at the respective facility's file for compliance purposes. Should you have any questions regarding this action, please call Pat Young, American Samoa Program Manager at (415) 744-1594 or Doug Liden of my staff at (415) 744-1920.

Sincerely,

Terry Oda
Chief, Permits Section
Water Management Division

Enclosures

cc: Steve Costa, CH2M HILL
Togipa Tausaga/Sheila Wiegman, ASEPA
Barry Mills, StarKist Samoa, Inc.
William D. Perez, VCS Samoa Packing Company



LEGEND

- ASG Sampling Station
- Utulei WWTP Station
- CH2M HILL Field Measurement Station (1/19/91)
- New sampling station as per permit modifications, effective 11/10/95.
- * ASPA Station B will be utilized and referred to as Station 10A.

REVISED **FIGURE 2. LOCATION OF WATER QUALITY STATIONS IN PAGO PAGO HARBOR**

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2~~-revised~~):

Offshore Station	Vicinity	Location	Coordinates ~~Latitude~~ West Longitude		~~Longitude~~ South Latitude	
5	Transition Zone		170° 39' ~~54.282"~~	~~.72W~~	14° 17' ~~53.468"~~	~~.88S~~
~~5A~~	~~Transition Zone~~	~~West~~	~~170° 40' 13.000"~~		~~14° 18' 29.000"~~	
6	Outer harbor	Central	170° 40' ~~11.372"~~	~~.20W~~	14° 17' ~~31.322"~~	~~.52S~~
~~6A~~	~~Outer harbor~~	~~West~~	~~170° 40' 18.500"~~		~~14° 17' 31.000"~~	
7	Outer harbor	East, S.	170° 39' ~~56.236"~~	~~.93W~~	14° 17' ~~22.339"~~	~~.37S~~
8	Outer harbor	East	170° ~~39'~~ 53.960"	~~40'.07W~~	14° 17' ~~10.830"~~	~~.17S~~
8a	Middle harbor	East	170° 40' ~~5.529"~~	~~.13W~~	14° 16' ~~51.575"~~	~~.88S~~
9	Middle harbor	East	170° 40' ~~9.006"~~	~~.18W~~	14° 16' ~~39.561"~~	~~.66S~~
9a	Middle harbor	East	170° 40' ~~34.862"~~	~~.67W~~	14° 16' ~~34.905"~~	~~.58S~~
10	Middle harbor	West	170° 40' ~~39.508"~~	~~.75W~~	14° 16' ~~55.259"~~	~~.87S~~
~~10A~~	~~Middle harbor~~	~~West~~	~~170° 40' 20.000"~~		~~14° 17' 10.000"~~	
11	Inner harbor	Center, E.	170° 40' ~~54.092"~~	~~.90W~~	14° 16' ~~34.295"~~	~~.58S~~
11a	Inner harbor	Center, E.	170° 41' ~~6.540"~~	~~.13W~~	14° 16' ~~38.573"~~	~~.62S~~
12	Inner harbor	Center	170° 41' ~~20.769"~~	~~.33W~~	14° 16' ~~36.564"~~	~~.60S~~
13	Inner harbor	Center, W.	170° 41' ~~42.849"~~	~~.71W~~	14° 16' ~~30.008"~~	~~.50S~~
14	Middle harbor	Diffuser	170° 40' ~~1.678"~~	~~.03W~~	14° 16' ~~58.934"~~	~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' ~~6.243"~~	~~.12W~~	14° 16' ~~45.692"~~	~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' ~~13.483"~~	~~.17W~~	14° 16' ~~57.273"~~	~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° ~~40'~~ 1.158"	~~39'.91W~~	14° 16' ~~54.398"~~	~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° ~~39'~~ 59.177"	~~40'.08W~~	14° 17' ~~8.862"~~	~~.10S~~

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	~~continuous(1)~~	~~monthly~~	~~semi-annual(2)~~
pH		"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Dissolved Oxygen	mg/l	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
~~Suspended Solids~~	~~mg/l~~	"	"		"	
Light Penetration	ft.	"	grab		"	~~semi-annual(2)~~
Turbidity	NTU	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Salinity	ppt	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Chlorophyll a ~~(3)~~	µg/l	"	grab		"	~~semi-annual(2)~~
Total Nitrogen ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
Total Phosphorus ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
Total Ammonia ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
~~Zinc~~	~~µg/l~~	~~(4)~~	"			~~semi-annual(2)~~
~~Copper~~	~~µg/l~~	~~(4)~~	"			~~semi-annual(2)~~

~~(1) Continuous vertical profiles.~~

~~(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.~~

~~(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).~~

~~(4) The following stations shall be sampled at the noted depths:~~
~~Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;~~
~~Stations 11 and 13: near surface and near bottom.~~
~~The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.~~

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid-depth.~~

~~A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.~~

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2~~-revised~~):

Offshore Station	Vicinity	Location	Coordinates ~~Latitude~~ ~~West Longitude~~		~~Longitude~~ ~~South Latitude~~	
5	Transition Zone		170° 39' ~~44.282"~~	~~.72W~~	14° 17' ~~53.468"~~	~~.88S~~
~~5A~~	~~Transition Zone~~	~~West~~	~~170° 40' 13.900"~~		~~14° 18' 29.000"~~	
6	Outer harbor	Central	170° 40' ~~21.372"~~	~~.20W~~	14° 17' ~~31.322"~~	~~.52S~~
~~6A~~	~~Outer harbor~~	~~West~~	~~170° 40' 18.500"~~		~~14° 17' 31.000"~~	
7	Outer harbor	East, S.	170° 39' ~~56.256"~~	~~.93W~~	14° 17' ~~22.339"~~	~~.37S~~
8	Outer harbor	East	170° ~~39'~~ 53.960"	~~40'.07W~~	14° 17' ~~10.830"~~	~~.17S~~
8a	Middle harbor	East	170° 40' ~~5.529"~~	~~.13W~~	14° 16' ~~51.575"~~	~~.88S~~
9	Middle harbor	East	170° 40' ~~9.006"~~	~~.18W~~	14° 16' ~~39.561"~~	~~.66S~~
9a	Middle harbor	East	170° 40' ~~34.862"~~	~~.67W~~	14° 16' ~~34.905"~~	~~.58S~~
10	Middle harbor	West	170° 40' ~~39.508"~~	~~.75W~~	14° 16' ~~55.258"~~	~~.87S~~
~~10A~~	~~Middle harbor~~	~~West~~	~~170° 40' 29.800"~~		~~14° 17' 10.000"~~	
11	Inner harbor	Center, E.	170° 40' ~~54.092"~~	~~.90W~~	14° 16' ~~34.295"~~	~~.58S~~
11a	Inner harbor	Center, E.	170° 41' ~~6.540"~~	~~.13W~~	14° 16' ~~38.573"~~	~~.62S~~
12	Inner harbor	Center	170° 41' ~~20.769"~~	~~.33W~~	14° 16' ~~36.564"~~	~~.60S~~
13	Inner harbor	Center, W.	170° 41' ~~42.849"~~	~~.71W~~	14° 16' ~~30.009"~~	~~.50S~~
14	Middle harbor	Diffuser	170° 40' ~~1.678"~~	~~.03W~~	14° 16' ~~58.934"~~	~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' ~~6.243"~~	~~.12W~~	14° 16' ~~45.692"~~	~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' ~~23.483"~~	~~.17W~~	14° 16' ~~57.271"~~	~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° ~~40'~~ 1.158"	~~39'.91W~~	14° 16' ~~54.398"~~	~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° ~~39'~~ 59.177"	~~40'.08W~~	14° 17' ~~8.862"~~	~~.10S~~

~~Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.~~

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	~~continuous(1)~~	~~monthly~~	~~semi-annual(2)~~
pH		"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Dissolved Oxygen	mg/l	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
~~Suspended Solids~~	~~mg/l~~	~~"~~	~~"~~		~~"~~	
Light Penetration	ft.	"	grab		"	~~semi-annual(2)~~
Turbidity	NTU	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Salinity	ppt	"	"	~~continuous(1)~~	"	~~semi-annual(2)~~
Chlorophyll a ~~(3)~~	µg/l	"	grab		"	~~semi-annual(2)~~
Total Nitrogen ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
Total Phosphorus ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
Total Ammonia ~~(3)~~	µg/l	"	"		"	~~semi-annual(2)~~
~~Zinc~~	~~µg/l~~	~~(4)~~	~~"~~			~~semi-annual(2)~~
~~Copper~~	~~µg/l~~	~~(4)~~	~~"~~			~~semi-annual(2)~~

~~(1) Continuous vertical profiles.~~

~~(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.~~

~~(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).~~

~~(4) The following stations shall be sampled at the noted depths:~~
~~Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;~~
~~Stations 11 and 13: near surface and near bottom.~~
~~The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.~~

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid depth.~~

~~A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.~~

Appendix II

Combined Sampling and Analysis Plan and Standard Operating Procedures

Plan of Study
for
Receiving Water Quality Sampling
Pago Pago Harbor, American Samoa

A Combined
Sampling and Analysis Plan
and
Standard Operating Procedures

Prepared for

StarKist Samoa (NPDES Permit AS0000019)
and
VCS Samoa Packing (NPDES Permit AS0000027)

Submitted to

United States Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL
and
Glatzel and Associates

October 1996 : Revision 2

Purpose

On 8 November 1995 the U.S. Environmental Protection Agency issued a modification to the receiving water quality monitoring requirements of the NPDES permits issued to StarKist Samoa and VCS Samoa Packing. This combined sampling and analysis plan and standard operating procedures (SAP/SOP) has been prepared in compliance with the permits and to maintain a consistent and acceptable quality of data for the monitoring program. This plan has been revised based on experience with the first water quality sampling episode in March 1996. The revisions are minor and consistent with the recommendations that will be presented in report of the March 1996 monitoring.

Scope

The data collection and sampling requirements of the permits are listed in this document, including that supporting or ancillary data not directly referenced in the permit but of value in interpreting results. The SAP/SOP also addresses the sample location and navigation methods to be used and the specific methods to be used to take field measurements and collect, process, store and ship sea water samples. Quality assurance and quality control (QA/QC) and reporting format are also discussed. It is assumed that the field team will be familiar with the types of oceanographic equipment to be used and detailed instructions for the correct use of such equipment is generally not discussed.

Data and Samples Description

The permit requires the in-field measurement of the following variables as continuous vertical profiles: temperature, pH, dissolved oxygen (DO), turbidity, and salinity. In addition a measurement of light penetration is required. The permit also requires the collection of samples for laboratory analysis of chlorophyll-a, total nitrogen, total phosphorous, and total ammonia at all stations. In addition, analyses for zinc and copper are required at selected stations. In support of the primary data collection and sampling the following information will be recorded at each location at the time of sampling and data collection: date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover.

Sampling Locations and Times

Sampling is to be done twice a year during the two main oceanographic seasons. The two oceanographic seasons are the tradewind and non-tradewind seasons, which are separated by short transition periods. Other studies being conducted under the permit are also aligned with these seasons. Sampling will normally be scheduled for the February-March and August-September-October time periods.

Sampling and data measurement locations consist of twenty (20) stations located throughout Pago Pago harbor and described by latitude and longitude and graphically in

the permit and permit modification. At each station location continuous vertical profiles will be taken, other data as described above will be recorded, and samples will be collected at the following depths: near surface, 30 feet, 60 feet, 90 feet, 120 feet, and near bottom. Where water depth is less than 120 feet samples will be collected at three depths including: near surface mid-depth, and near bottom. The sample collection for metals is abbreviated and samples will be collected at three depths (30 feet, 120 feet, and near bottom) at five (5) stations and at surface and near bottom at two stations. The stations for metals sampling are specified in the permit modification.

Station locations are specified in the permit both by latitude and longitude and graphically. Problems have been encountered previously in correlating the latitude-longitude coordinates with known or charted positions in Pago Pago Harbor. There are at least three datums in use in various references: Preliminary NAD (North American Datum) 1927, NAD 1927, and NAD 1983 which essentially corresponds to WGS (World Geodetic System) 1984 as typically used in satellite navigation systems and global positioning systems (GPS). Therefore, latitudes and longitudes derived from different sources can be significantly different for the same point or feature on the ground. The procedure described below will be used to avoid confusion in the future.

GPS positioning will be used for station locations. During the first data collection episode We will recorded, and permanently store, the WGS coordinates of the stations actually occupied for this sampling and will use the same coordinates for all future sampling episodes. Since differential GPS is not yet available in American Samoa one of two methods will be used for station location: installation of a base unit at a known bench mark or, during each sampling two known bench marks will be visited and the appropriate corrections will be recorded and applied to determine the station location. These methods should provide sufficient accuracy for water quality sampling (the occupation at two benchmarks will also provide an estimate of precision).

Sample Collection

Water samples will be collected from each depth specified in the permit using a Niskin type sampling bottle. Following the determination of total water depth as described below, the collection bottle will be lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. The bottle will then be triggered by a messenger dropped down the line and the bottle retrieved. Sample bottles, as described in Table 1, will be immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory. In addition, a minimum of two liters will be collected and stored on ice for chlorophyll-a filtering and analysis. The chlorophyll samples will be filtered through a Whatman grade GF/F glass microfiber filter paper (0.7 micron) using a vacuum pump apparatus within twenty-four hours of sample collection. The filters will be treated with manganese sulfate as a preservative and then stored in a freezer until being sent to the laboratory for analysis.

Parameter Measurements

As described above, in addition to the required continuous vertical profiles, the following information will be recorded at each location at the time of sampling and at the time of profile collection (if different): date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover. The continuous profiles may be taken at the same time or at different times from the sample collection. If the profiling is done at a different time, the same information listed above will be recorded. Also a measure of light penetration, as described by Secchi depth will be collected at each station either during the time of sample collection or vertical profiling. The various parameters will be measured as follows:

- Water depth will be measured using a non-recording portable fathometer or a measured and marked lead line
- Secchi depth will be determined by using a standard size and patterned Secchi disk lowered through the water column on a measured line
- Wind speed and direction will be estimated using a small hand held anemometer and compass
- Other meteorological parameters will be estimated visually

Conductivity, temperature, depth (pressure), DO, pH, and turbidity will be measured using an internally recording profiling instrument (CTD) which has been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density will be calculated from conductivity and temperature using the manufactures supplied software or other appropriate formulations. Backup instruments for all parameters will be available in case of failure of any or all of the profiling sensors. In such a case measurements will be taken using the individual grab samples.

The profiling instrument to be used should be tested dockside in a side-by-side test with calibrated meters for each parameter. This should be done prior to any sample collection. If any parameters recorded by the profiling instrument are not being measured and recorded in a satisfactory manner, alternative measurements should be taken. These alternative measurements should be done as follows:

- Temperature and DO must be measured in each individual grab sample at the time of sample collection
- Conductivity (salinity and density) and pH may be measured at the time of sample collection, or measured in subsamples from the samples to be filtered for chlorophyll-a analysis
- Turbidity will be measured in the laboratory at the time of nutrient analysis; this requires no extra sample collection and simply needs to be indicated on the chain of custody forms

Sample Handling

The general procedure for handling samples is outlined below. Note that special procedures for the chlorophyll-a samples are discussed above. In the field, sample collection should use the following procedure:

- Label the individual grab sample containers as listed in Table 1 with an appropriate and unique sample identifier and date and time, bottles should be pre-labeled prior to sample collection in the field
- Fill the bottles to the top, and cover the container securely with its lid.
- Store all samples in coolers on ice at a temperature of approximately 4 °C until packaging for shipment to the laboratory.

One chain-of-custody form is required for each cooler of samples that will be shipped. Sample identification on the chain-of-custody should match the labels on the sample containers exactly. Any multiple samples or backup samples must be appropriately indicated on the chain of custody form. The methods requested should be shown on the chain of custody form. Also, note on the chain-of-custody form that samples are sea water.

Prior to shipping, acid preserved samples should be checked for pH and the pH should be adjusted as necessary to meet the requirements listed in Table 1. Each glass sample bottle should be wrapped in bubble-wrap or an equivalent packaging material and placed in a plastic zip-lock bag. Plastic sample bottles should be placed in a plastic zip-lock bags as well. As much air as possible should be removed from the bag prior to sealing it. Too much air inside the bags will expand during the flight and pop the bag open. Place sample bottles inside the cooler. Packaging material (bubble wrap or equivalent) should be placed in the cooler to prevent bottles from moving and impacting each other.

Ice or an equivalent means (such as chemical cold packs) must be included to keep the samples cold during shipping. Do not use dry ice to pack the samples. If ice is used, precautions should be taken to prevent melted ice from leaking out of the cooler during shipping. These include taping any drain plugs in the cooler shut with duct tape or strapping tape, and "double-bagging" the ice cubes in zip-lock bags. As with the bags used to hold the sample bottles, as much air as possible should be removed from the bags prior to sealing.

The chain-of-custody form for each cooler should be signed, placed in a zip-lock bag, and taped with duct tape to the inside of the cooler lid. The cooler should be taped securely shut with strapping tape or other strong packaging tape to prevent it from opening during shipping.

Quality Assurance And Quality Control

The quality assurance and quality control objectives for the study are to collect physical and hydrographic data and representative samples at predetermined locations and provide

field and laboratory measurements that are of known and acceptable quality. A list of field equipment is given in Table 2. The following requirements will be followed to meet the objectives:

- Maintain and document accurate positioning for sample collection
- Verify the GPS at known points near or within the study area
- Provide field equipment redundancy (backup equipment)
- Develop and use the field standard operations procedures (SOP) as described in this document
- Obtain all equipment prior to the beginning of the field collections and check to verify correct operation
- Any instrument requiring calibration will be checked and calibrated upon its arrival to confirm that it is in working condition.
- Examine samples as collected and subsequent data analysis by experienced scientists
- Provide verifiable laboratory chemical analyses with appropriate QA to evaluate accuracy and precision targets

Health and Safety Considerations

The data and sample collection and preparation should be done or directly supervised by staff that are experienced with this type of work and are fully aware of all health and safety practices that apply in such cases.

Reporting

A report of the results will be provided to USEPA and ASEPA after receipt and post processing of the results of the chemical sample analyses. Field data will be summarized and positioning data will be tabulated. Laboratory chemical data will be reviewed to determine whether analytical accuracy and precision targets were achieved and to assess the laboratory quality assurance. Chemical analyses results will be presented in tabular formats. Any proposed revisions to the study plan will be presented in the report. Review comments from USEPA and ASEPA will be incorporated into the revised study plan as appropriate.

- An introduction presenting the background, rationale, objectives and setting of the study
- A section describing the approach and methods, including any deviations or changes from the study plan, and justification for any such deviations

- A section presenting summary results of the information gathered
- A section discussing any pertinent conclusions, recommendations, and proposed changes to the study
- Appendices containing the study plan, a record of approvals of any previous changes to the study, the laboratory reports, chain-of-custody records, and any other pertinent information

Table 1
Pago Pago Harbor Water Quality Monitoring
Sample Analysis And Handling Procedures

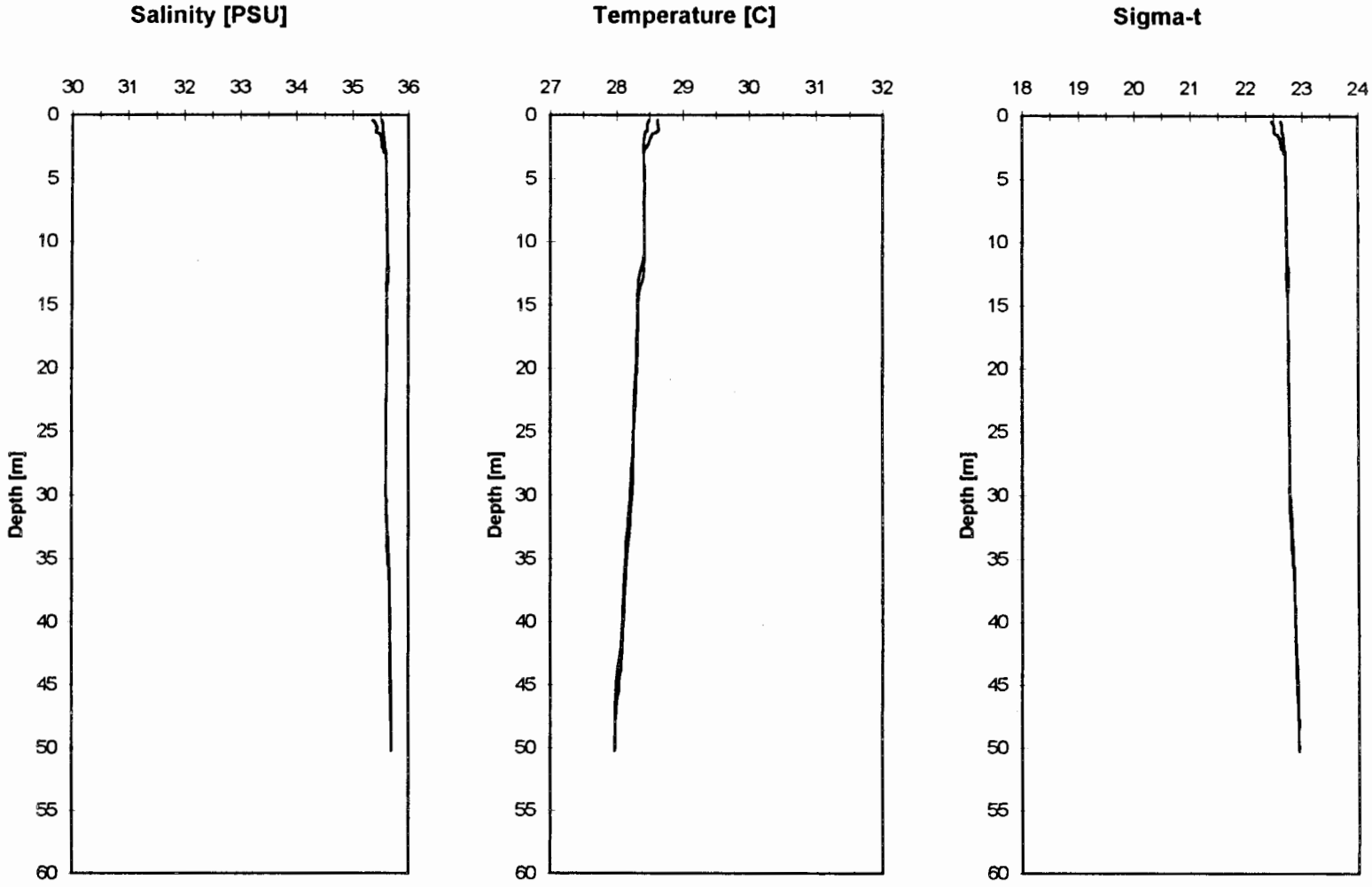
ANALYTE	METHOD	REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - $H_2 SO_4$
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m [3]	3 months	Whatman grade GF/F glass microfiber filter (0.7 micron)	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper	EPA 200.7[3]	2 µg/l			

Notes:
[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of filed team leader.
[2] Holding times for turbidity and nitrite nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.
[3] To be analyzed following extraction by coprecipitation to achieve the requested detection limit

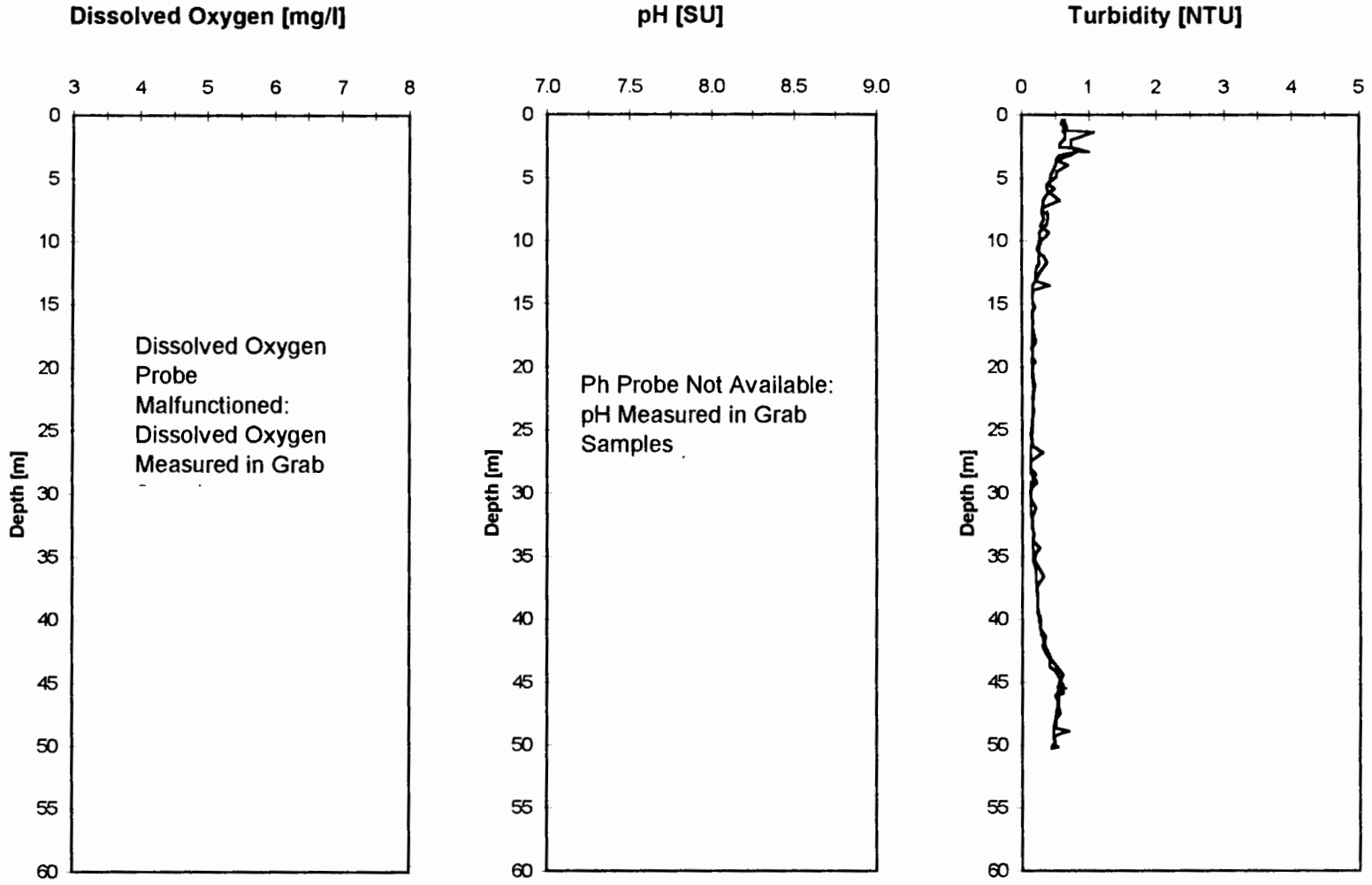
Table 2 Field Equipment for Field Data Measurement and Sample Collection			
Equipment Item	**Purpose**	**Number of Units**	**Accuracy Standard**
Work Vessel	Serves as field sampling platform	1	N/A
GPS (or equivalent)	Station positioning system using GPS	1	± 10 meters
Tape measure and/or marked line	Establish depths at sampling locations (backup for fathometer)	1	± 1 foot
Niskin Sampling Bottles (or equivalent)	Collect water samples	2	N/A
Conductivity, Salinity, Temperature (SCT) Meter	Backup for profiling instrument	1	Temp: ± 0.2 °C Cond: ± 0.5 mS/cm Salinity: ± 0.2 PSU
pH Meter	Backup for profiling instrument		pH: ± 0.2 SU
Dissolved Oxygen meter	Backup for profiling instrument	1	DO: ± 0.2 mg/l
Profiling CTD with DO, pH, and Turbidity sensors	Record temperature, conductivity, depth	1	Temp: ± 0.1 °C Cond: ± 0.1 mS/cm Depth: ± 0.1 meter pH: ± 0.2 SU DO: ± 0.2 mg/l Turbidity: ± 0.1 NTU
Vacuum Filtering Apparatus and Filter Paper	Prepare chlorophyll samples	1	N/A
Fathometer	Measure depth at each station	1	± 1 foot
Sample Containers and Preservatives	Collection of receiving water samples for chemical analyses, including sample to be filtered for chlorophyll-a analysis	As required	Pre-cleaned sample containers
Ice Chests	Hold sample jar, cool samples on ice, and ship samples	As required	Pre-cleaned containers
Notes: N/A = Not applicable			

Appendix III

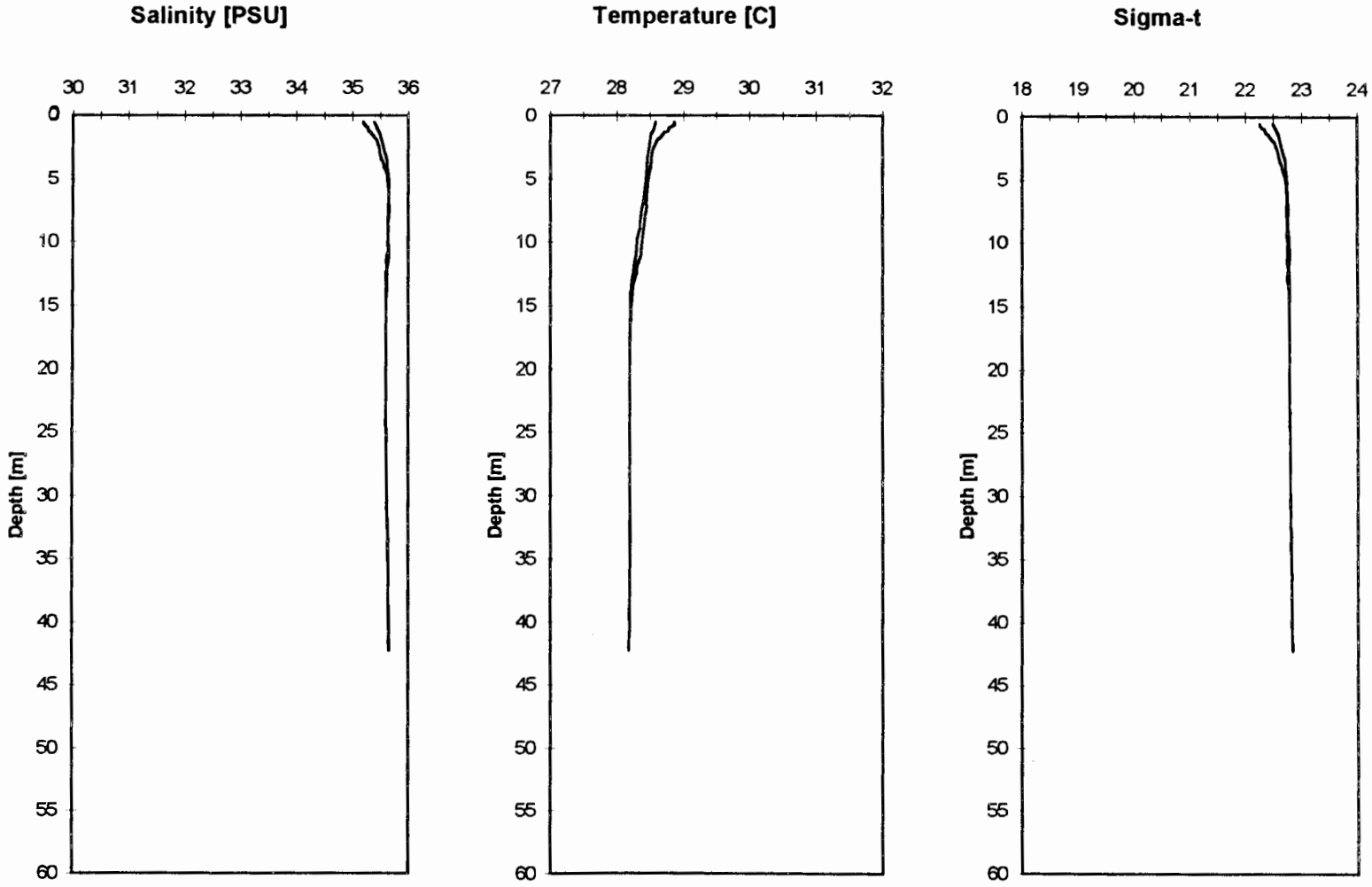
Vertical Profile Data for Each Station



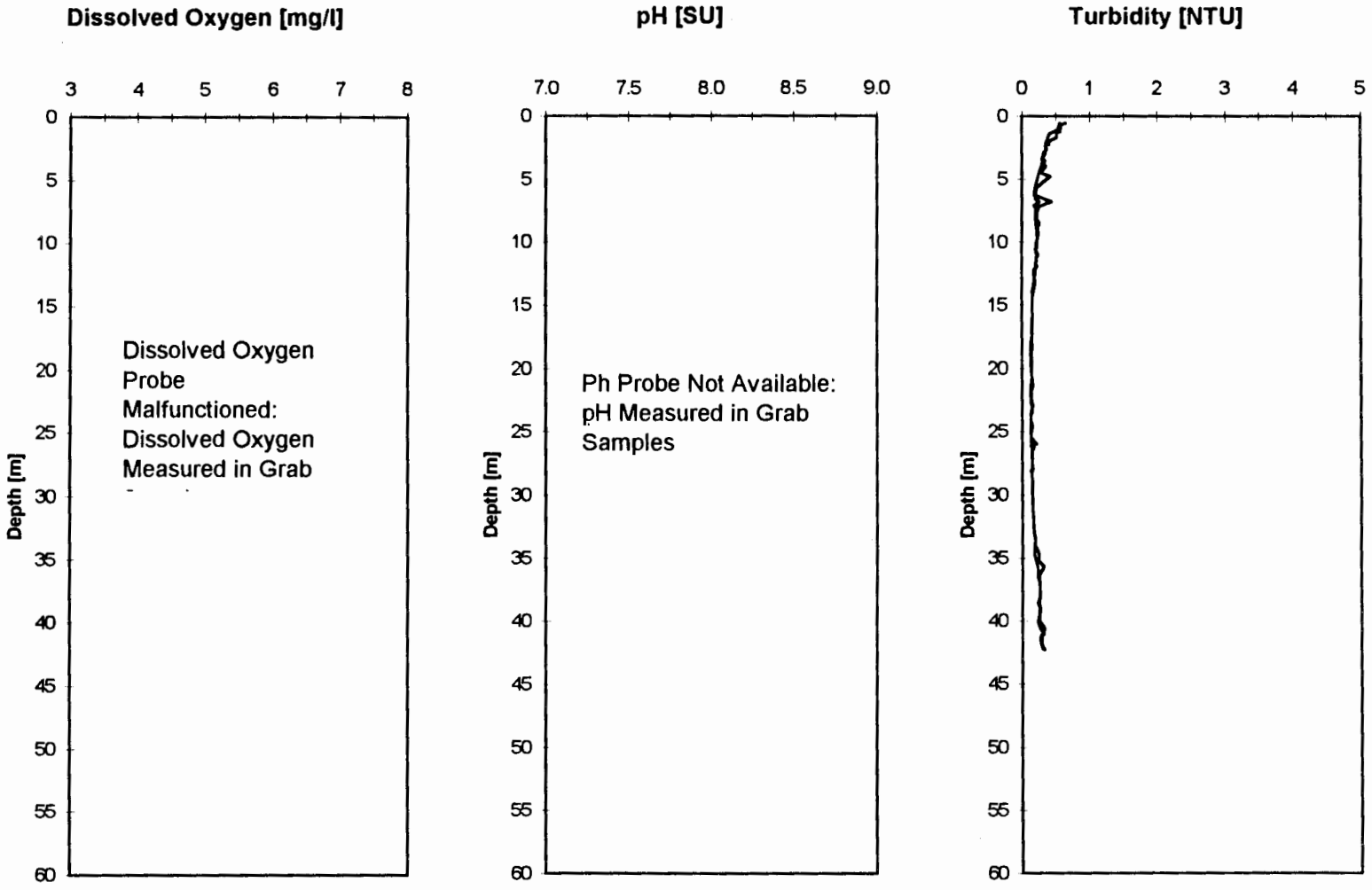
Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



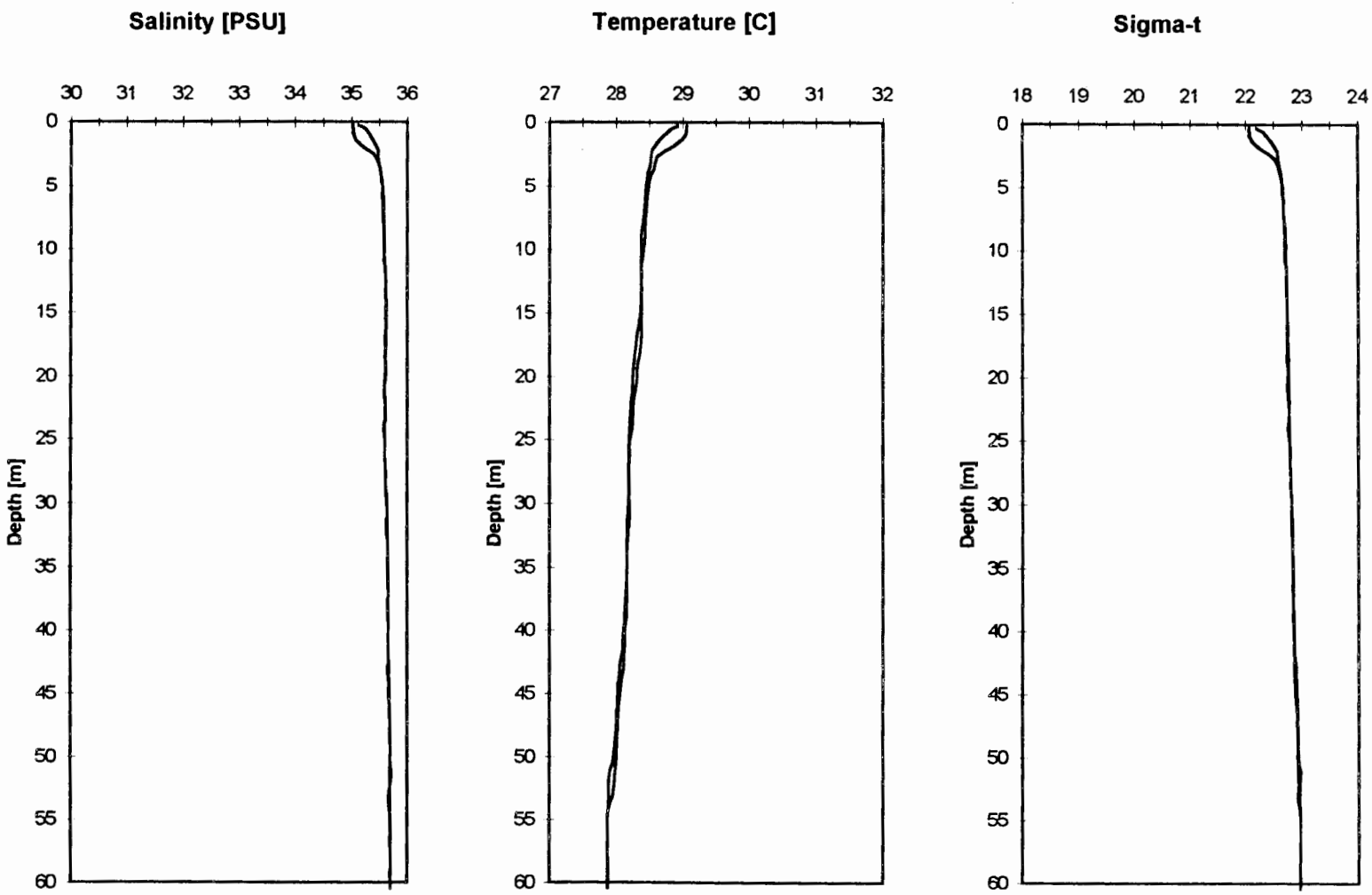
Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



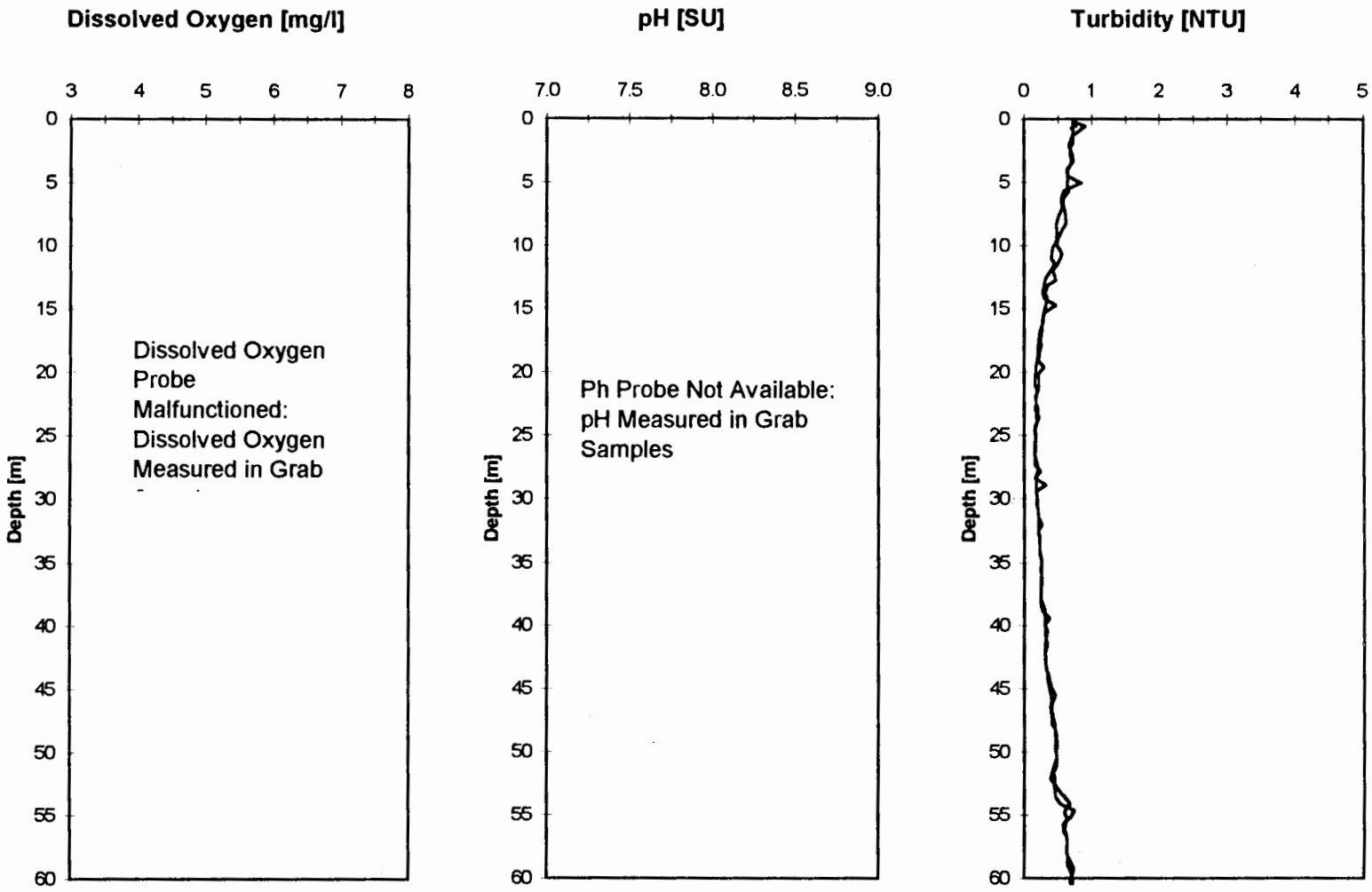
Station 5A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



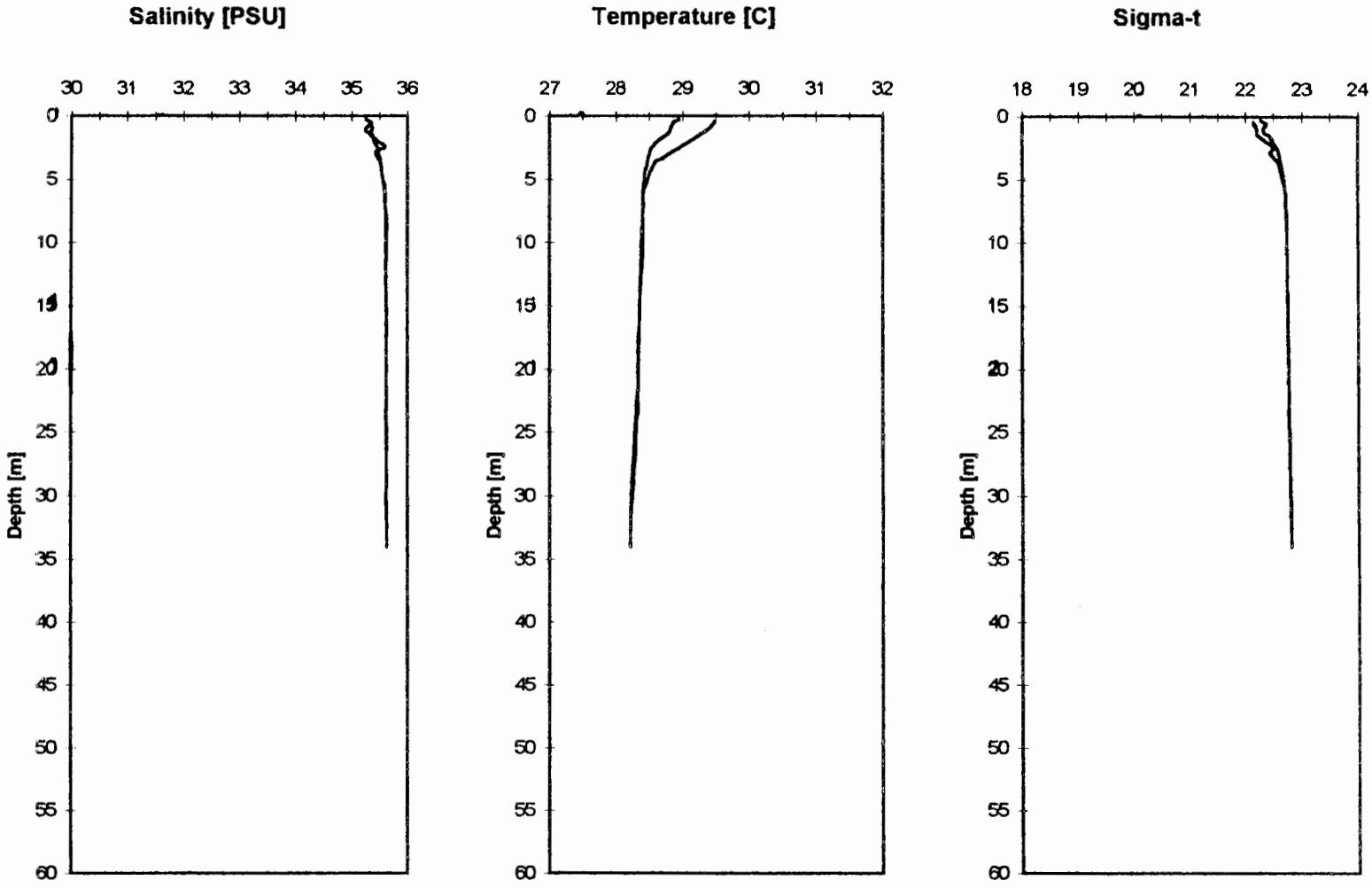
Station 5A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



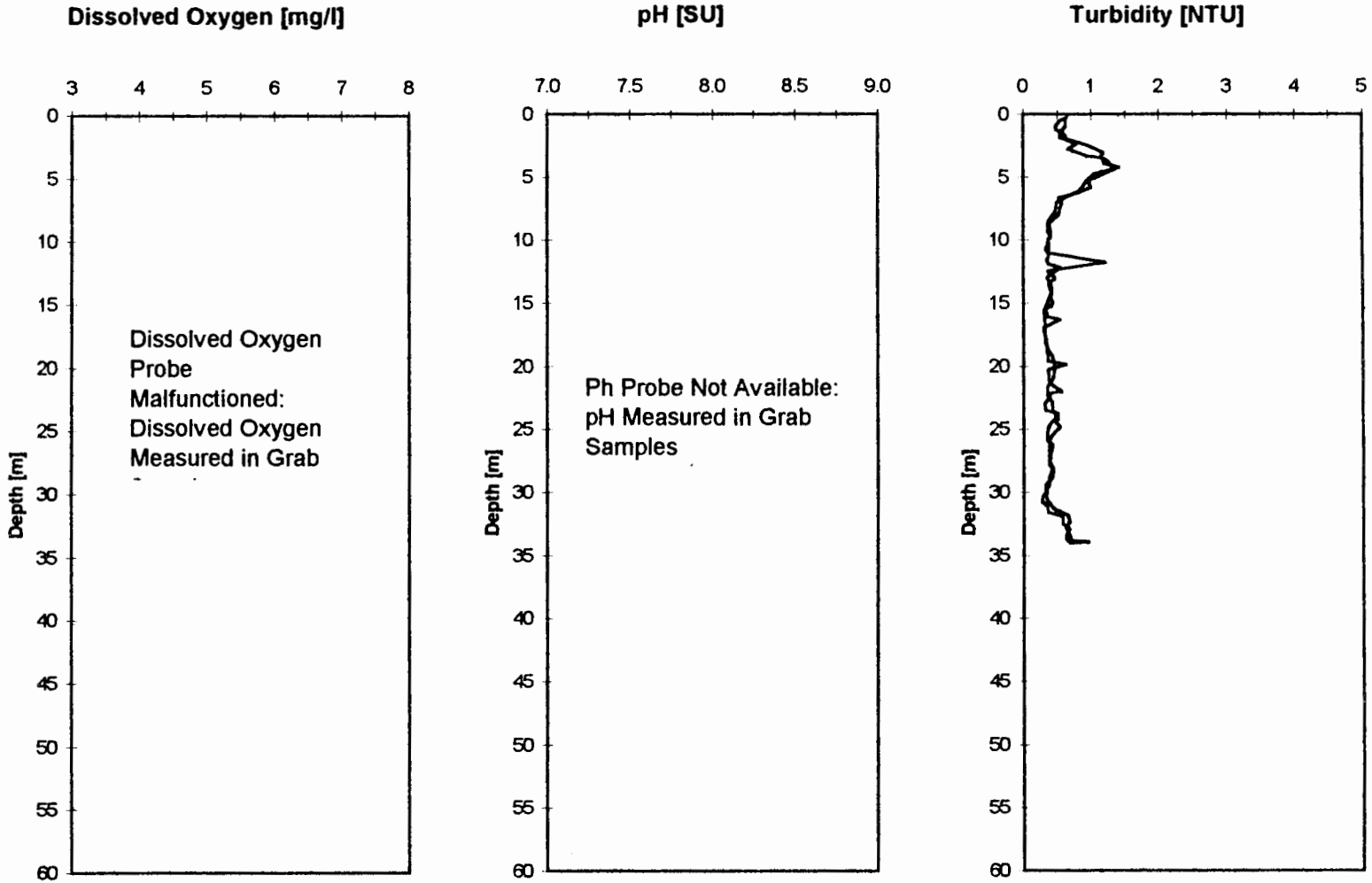
Station 6
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



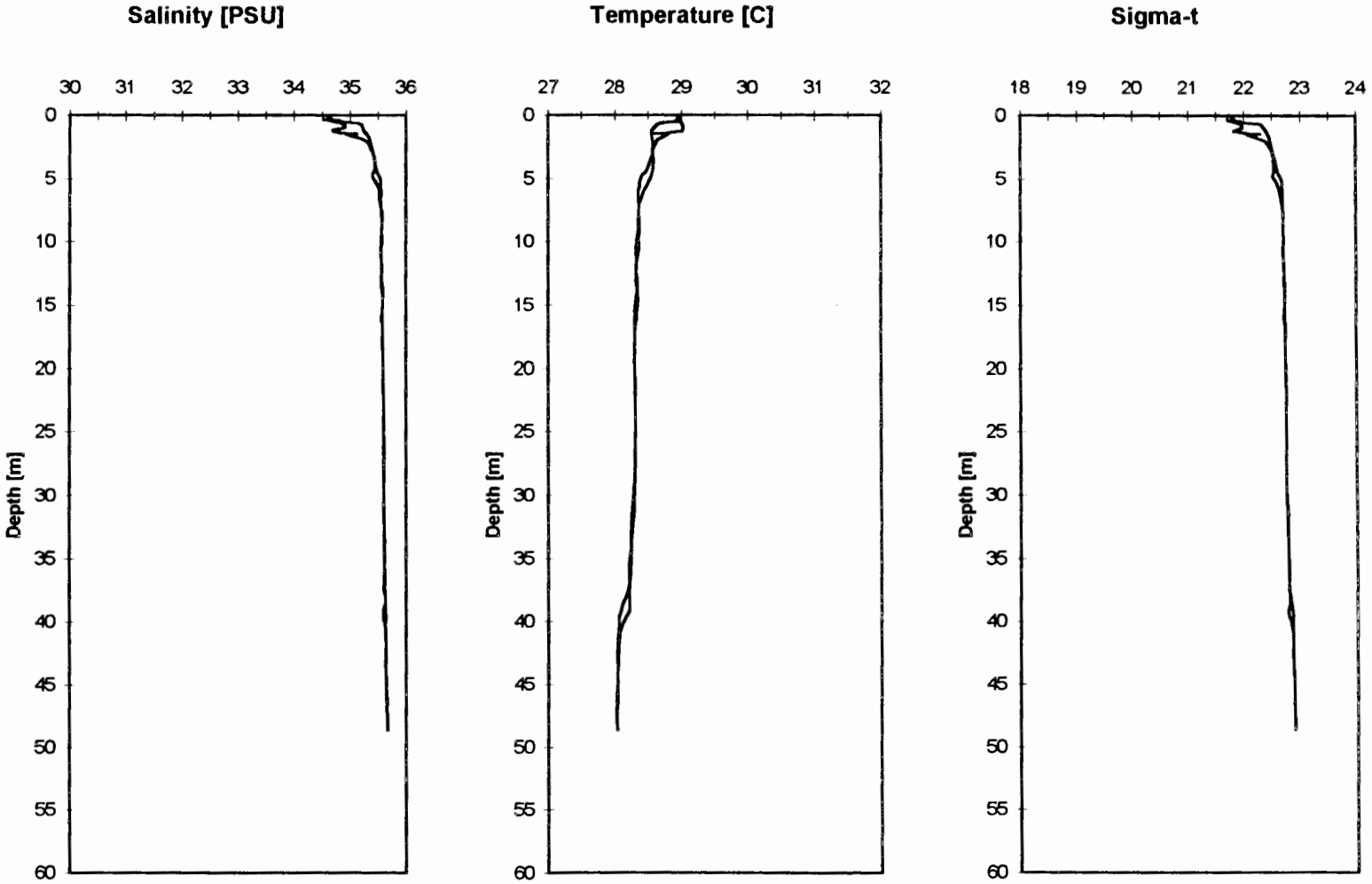
Station 6
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



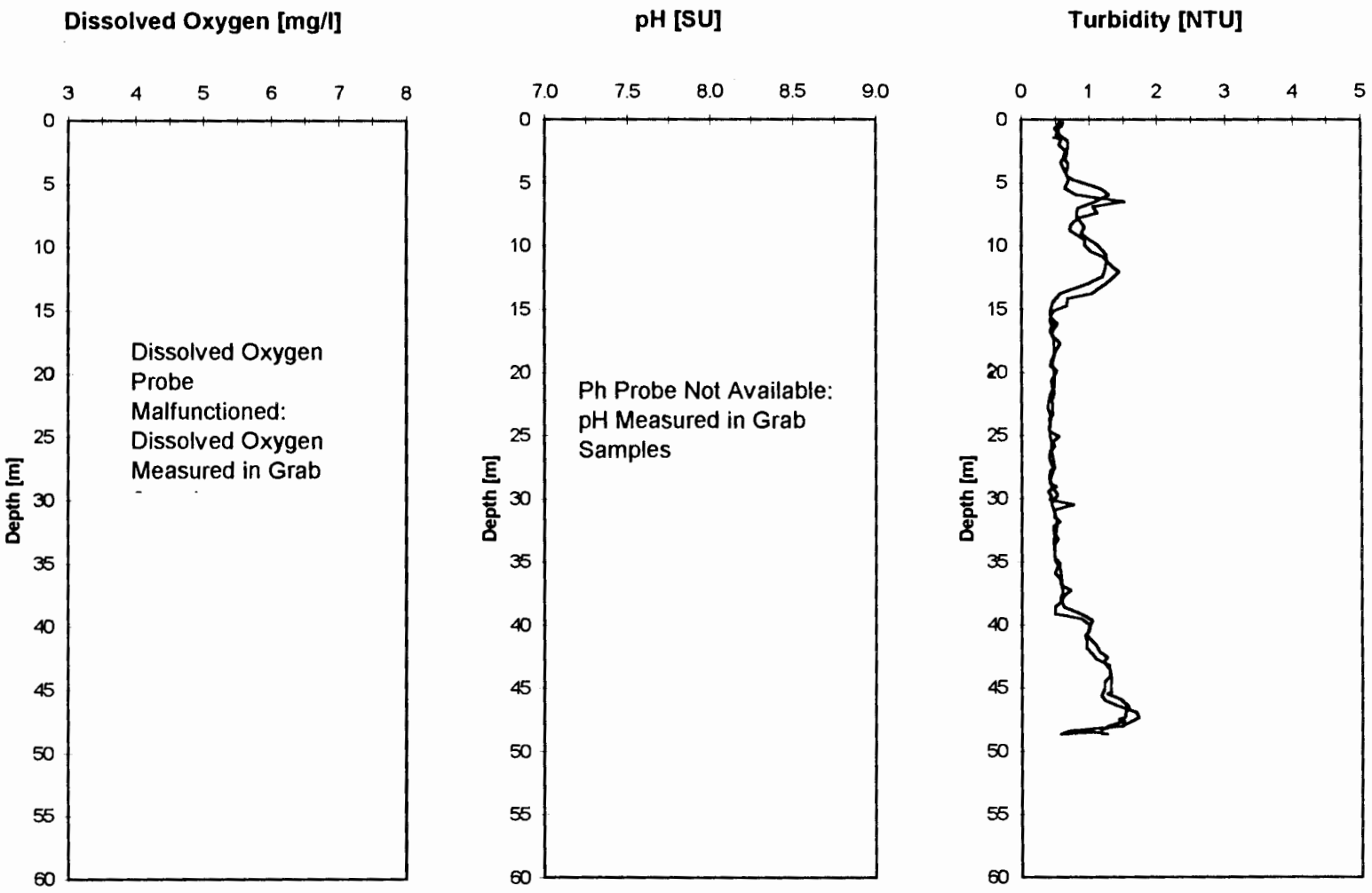
Station 6A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



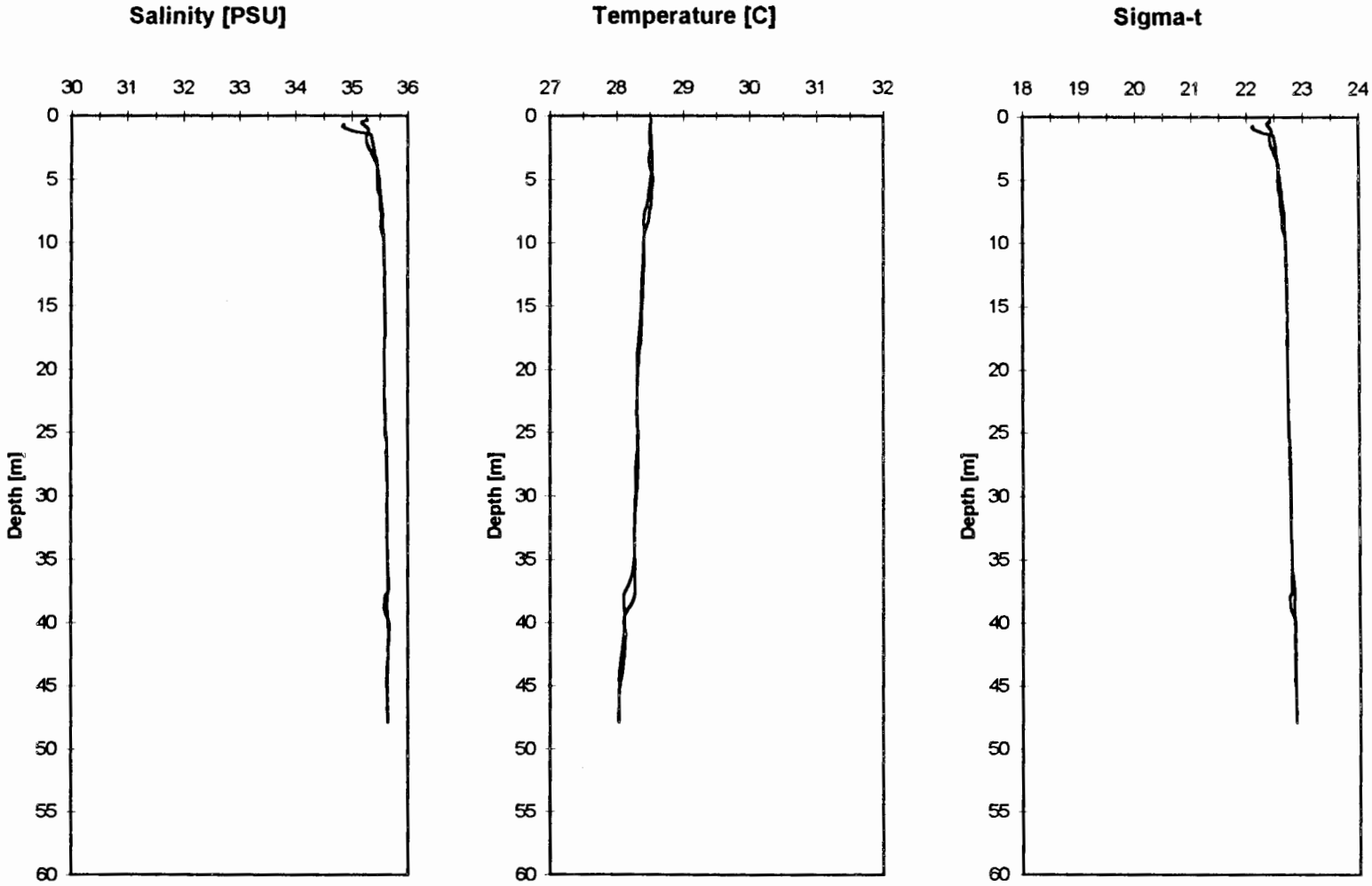
Station 6A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



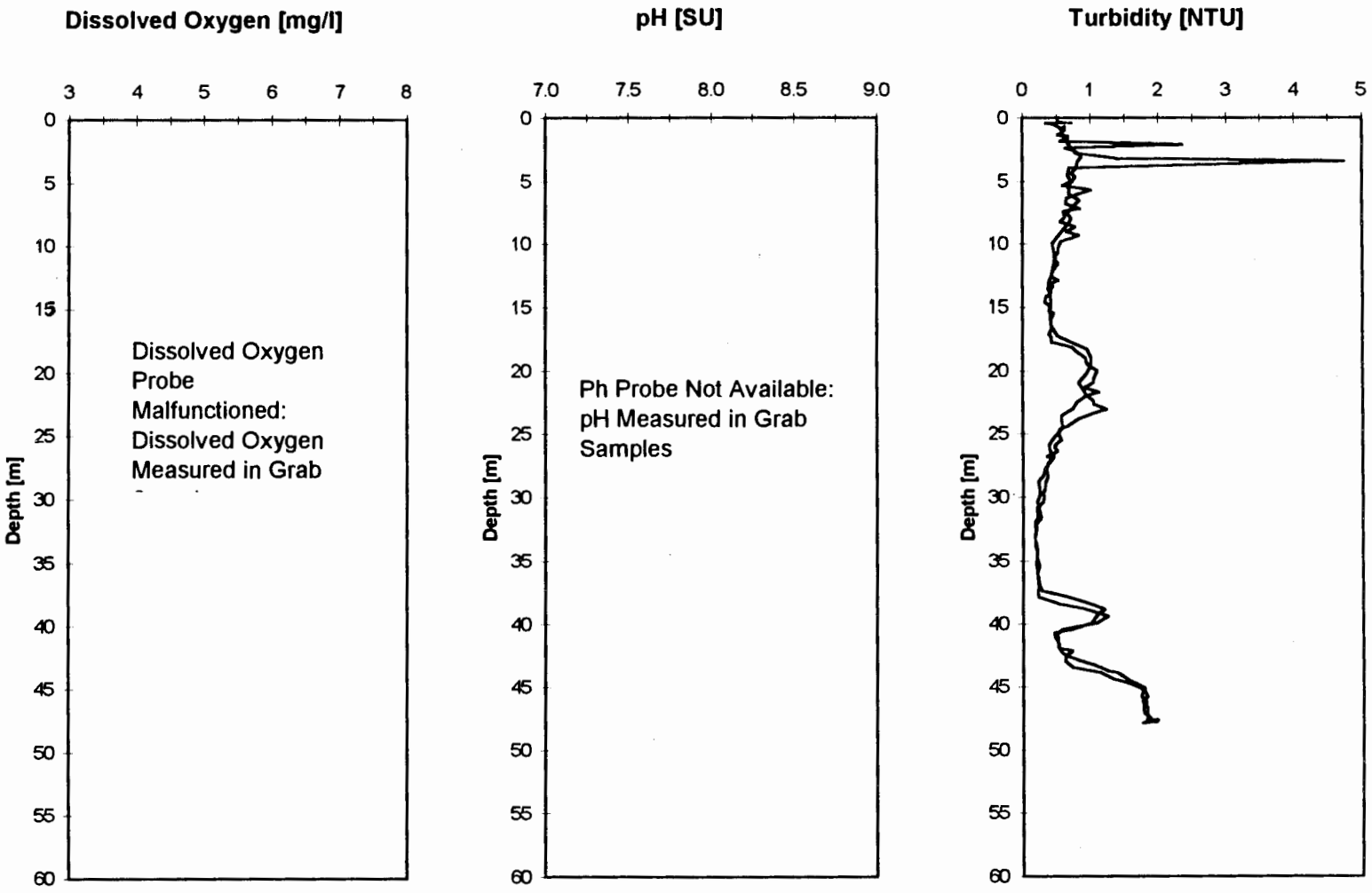
Station 7
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



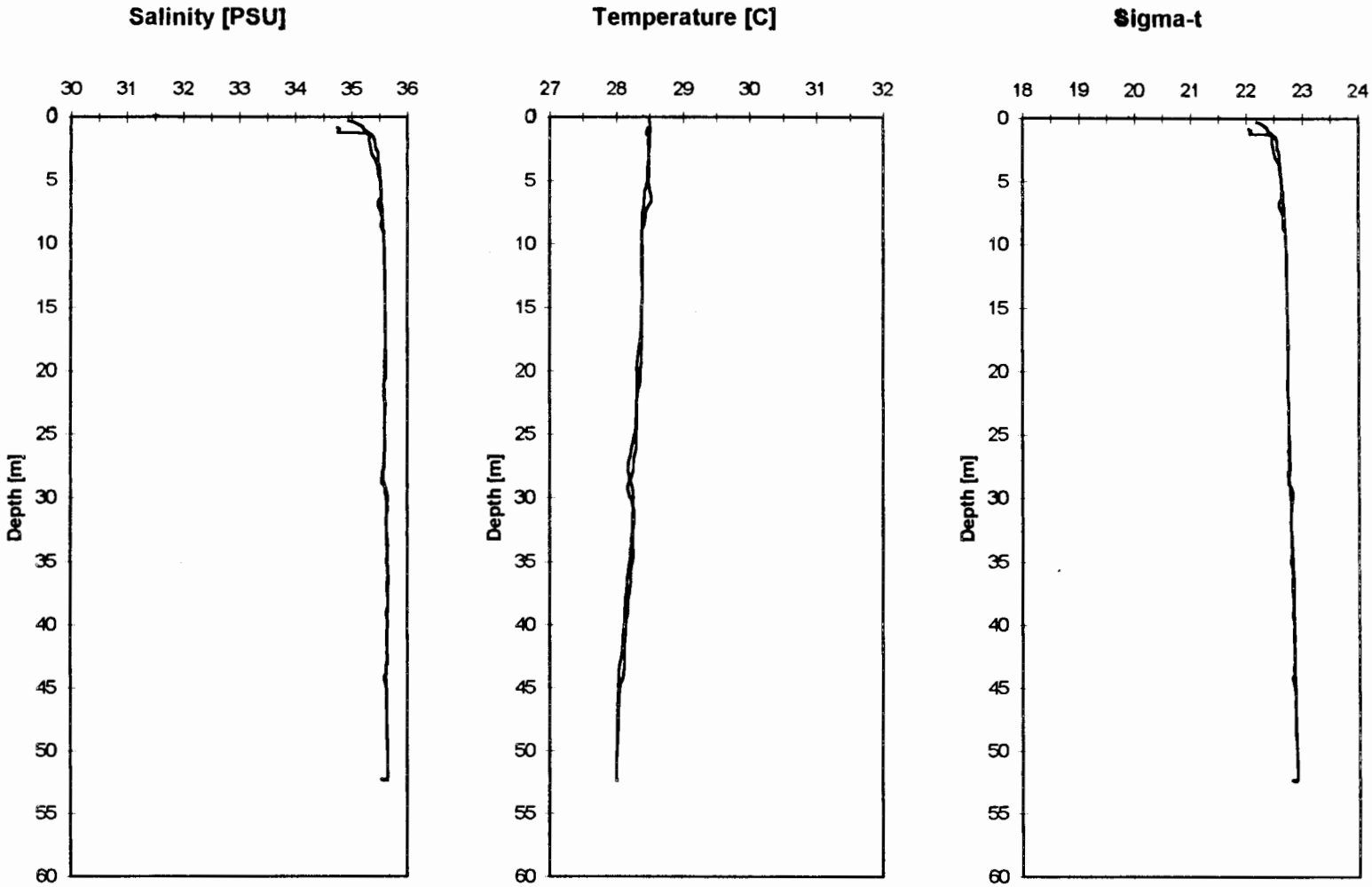
Station 7
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



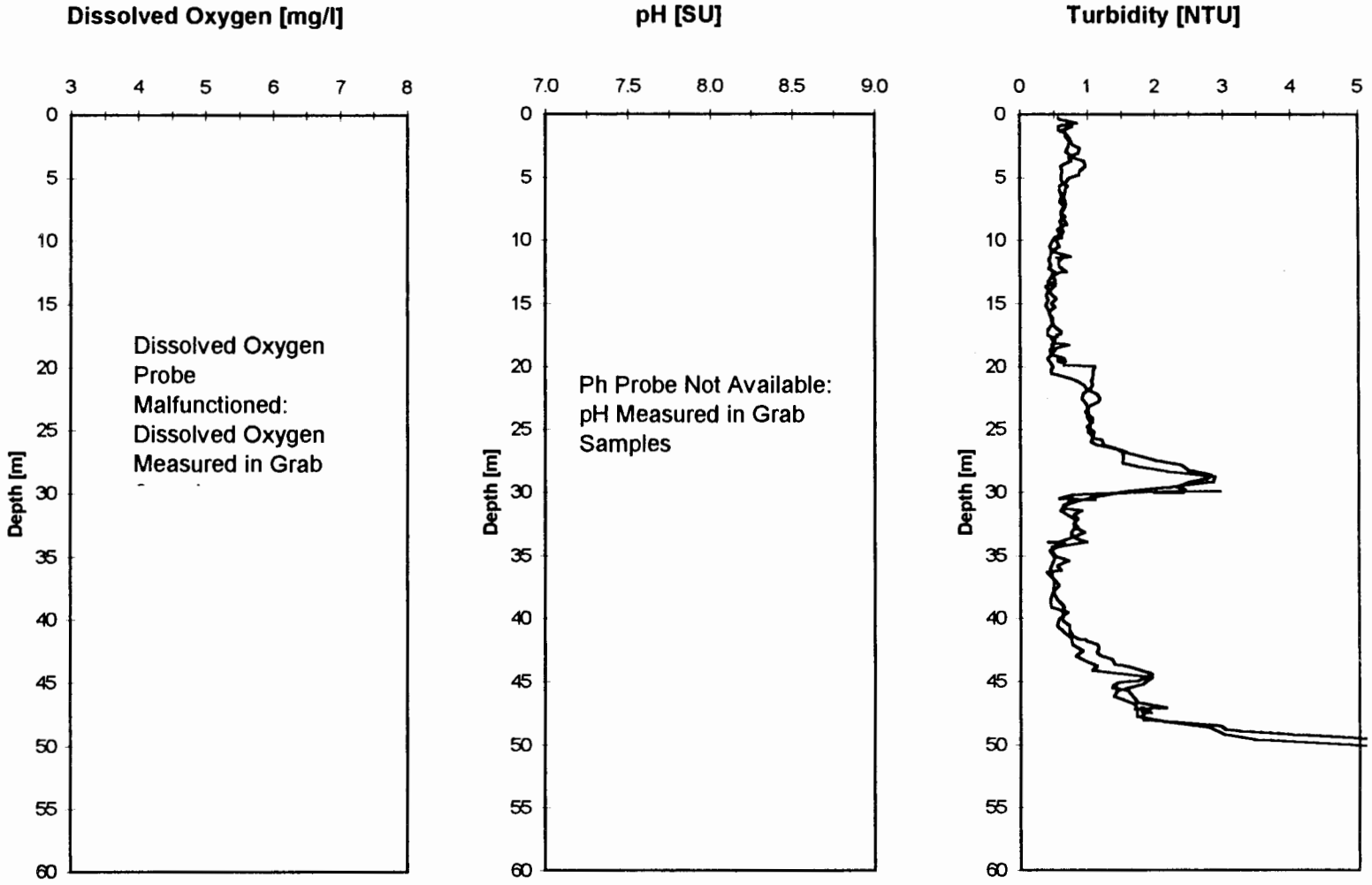
Station 8
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



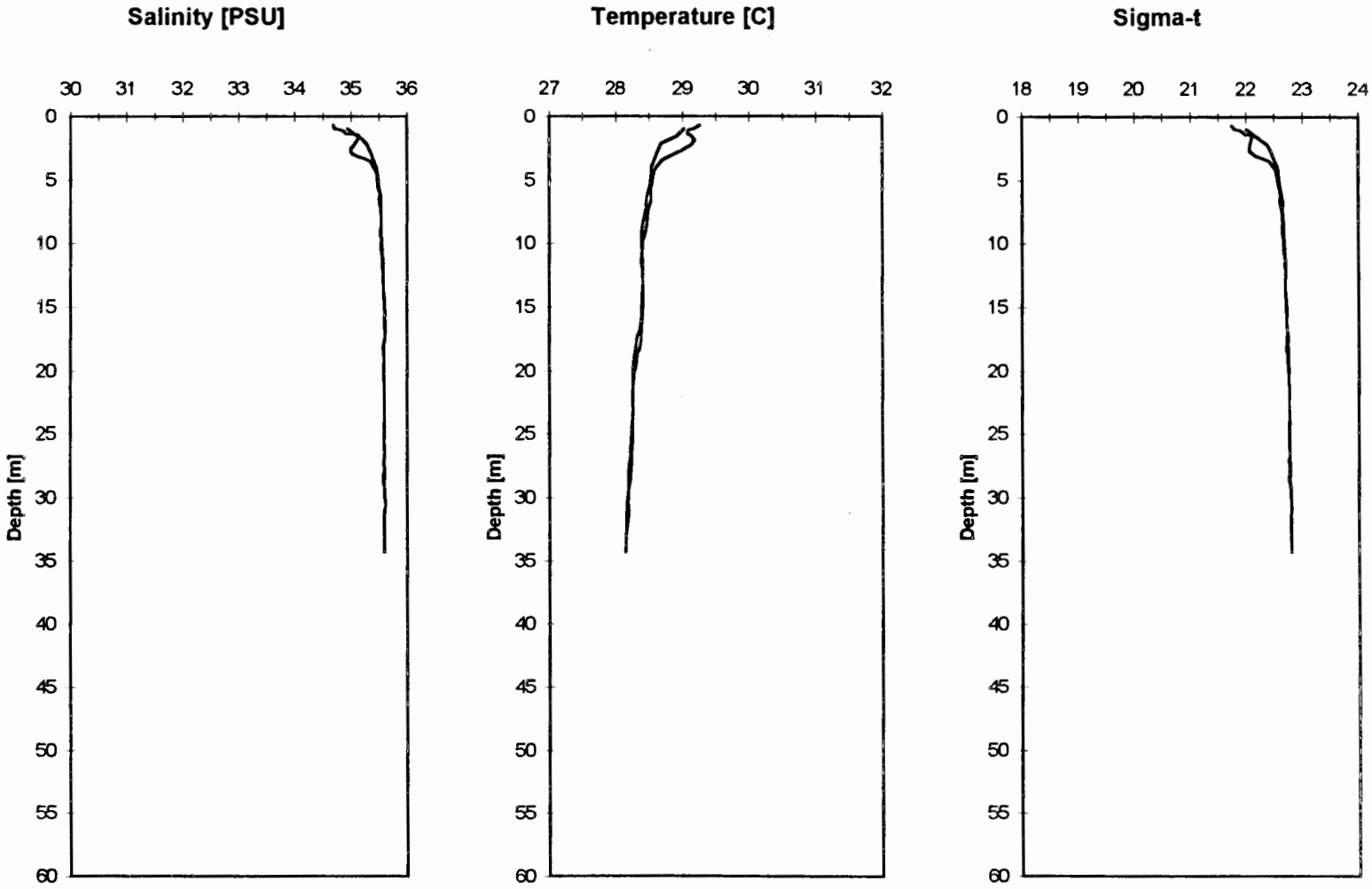
Station 8
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



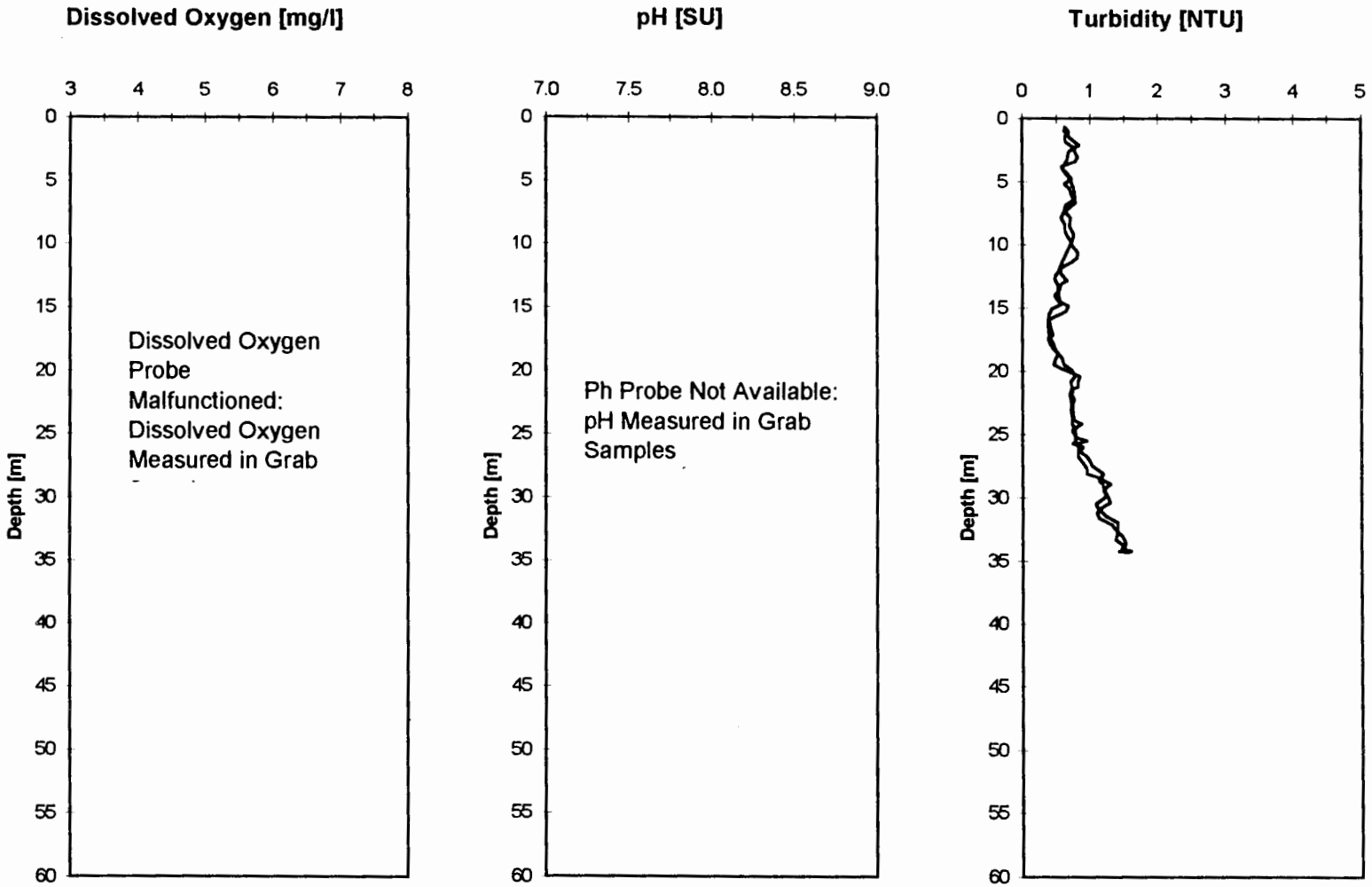
Station 8A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



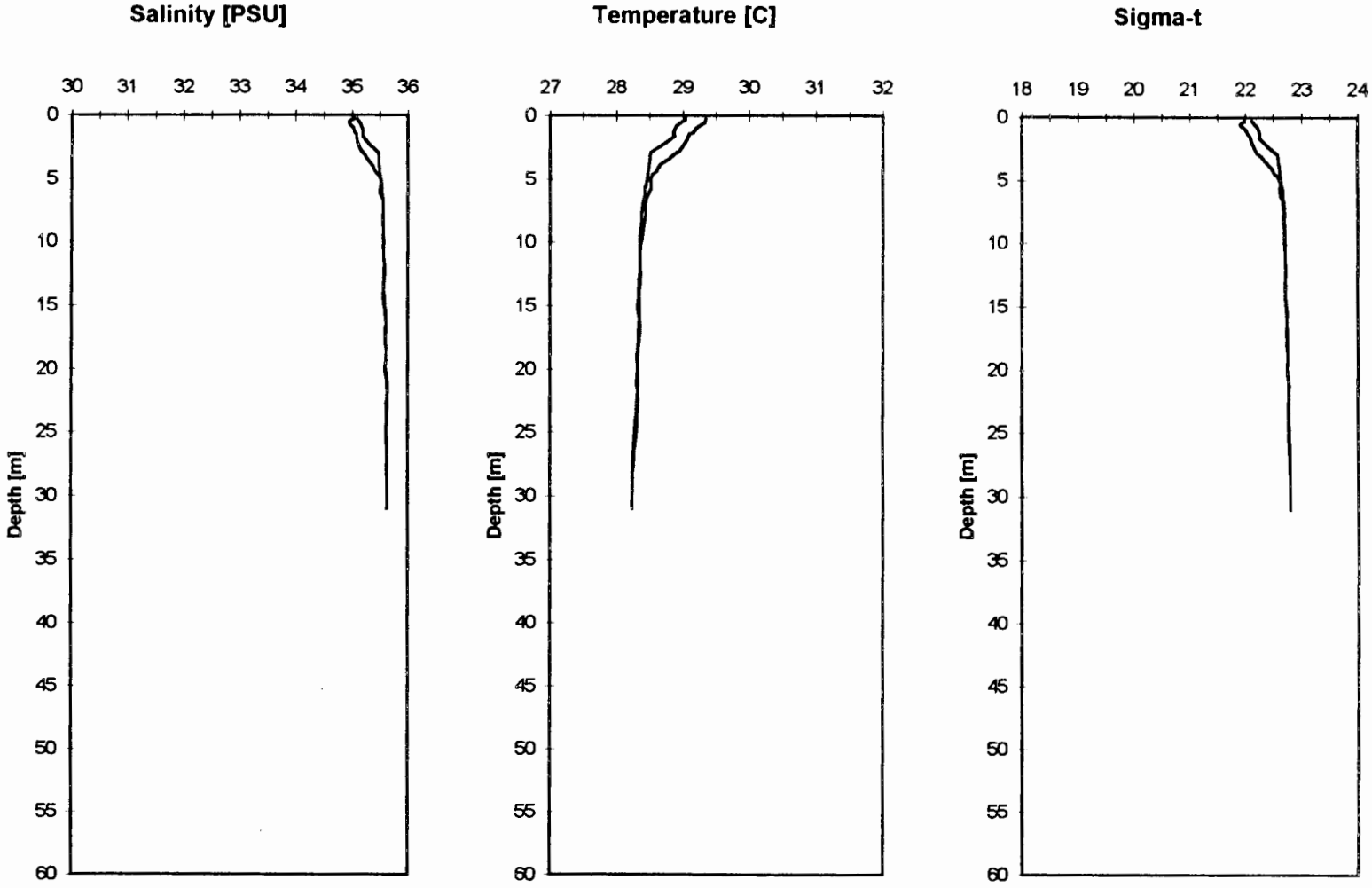
Station 8A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



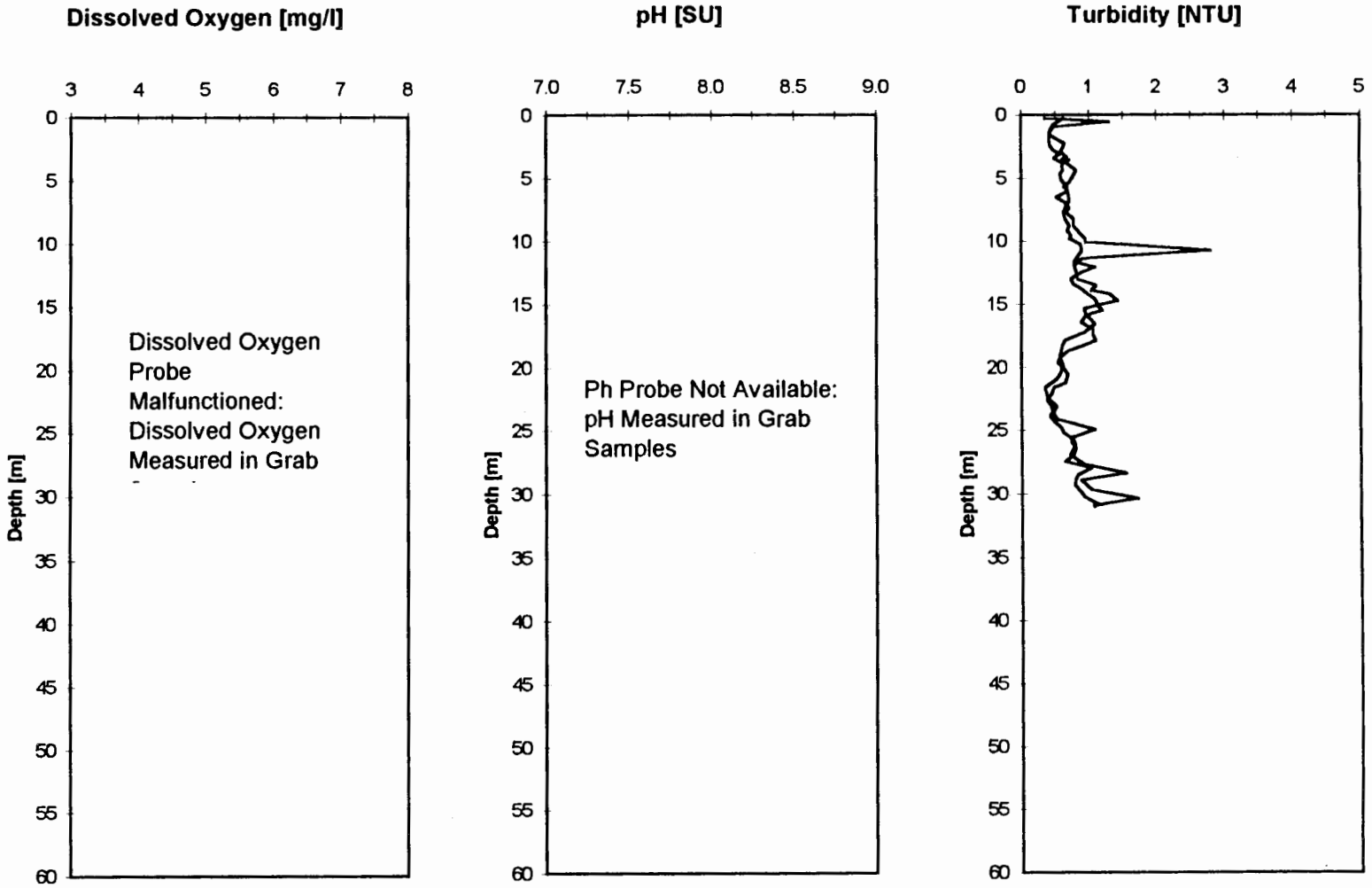
Station 9
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



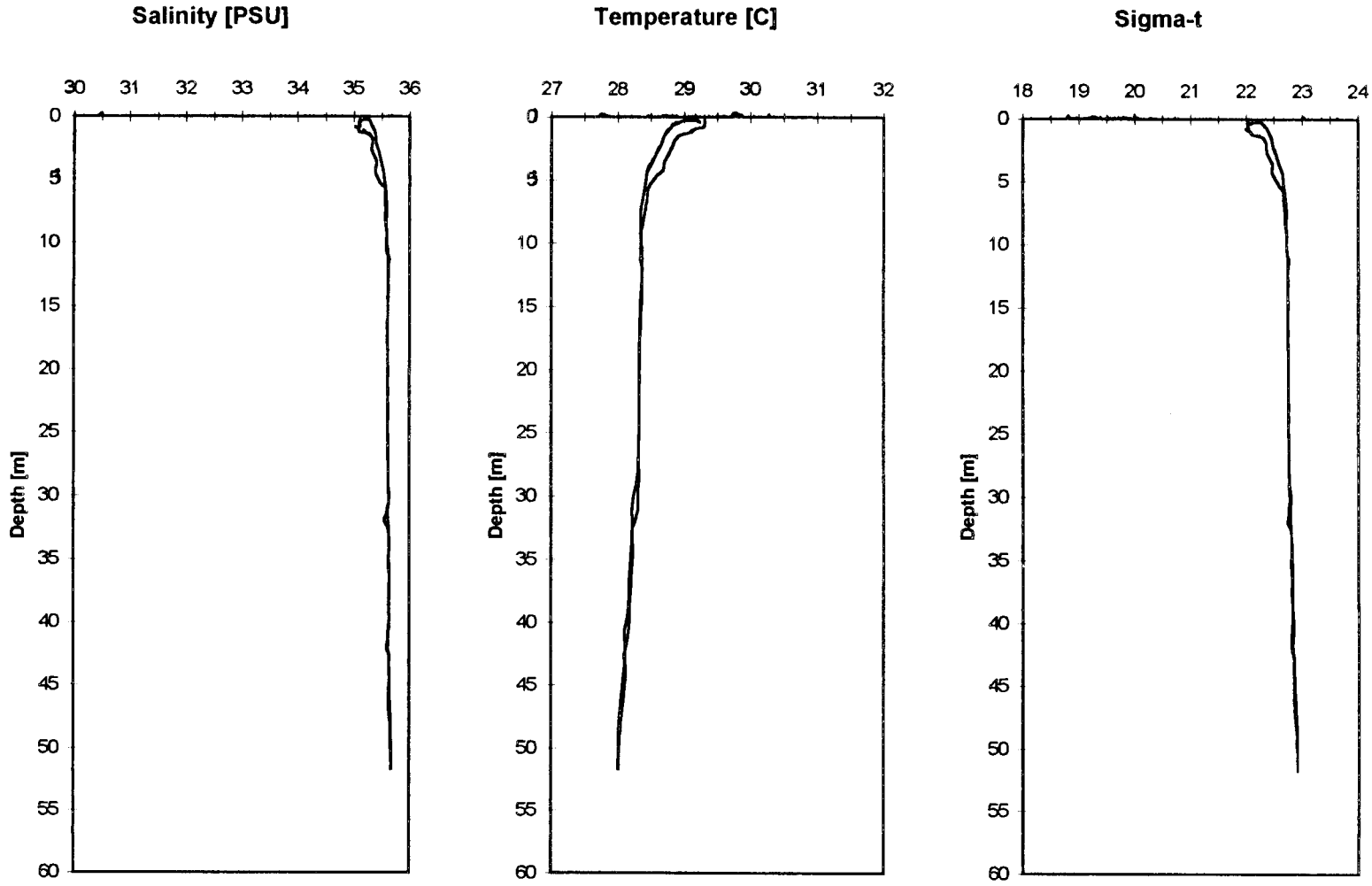
Station 9
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



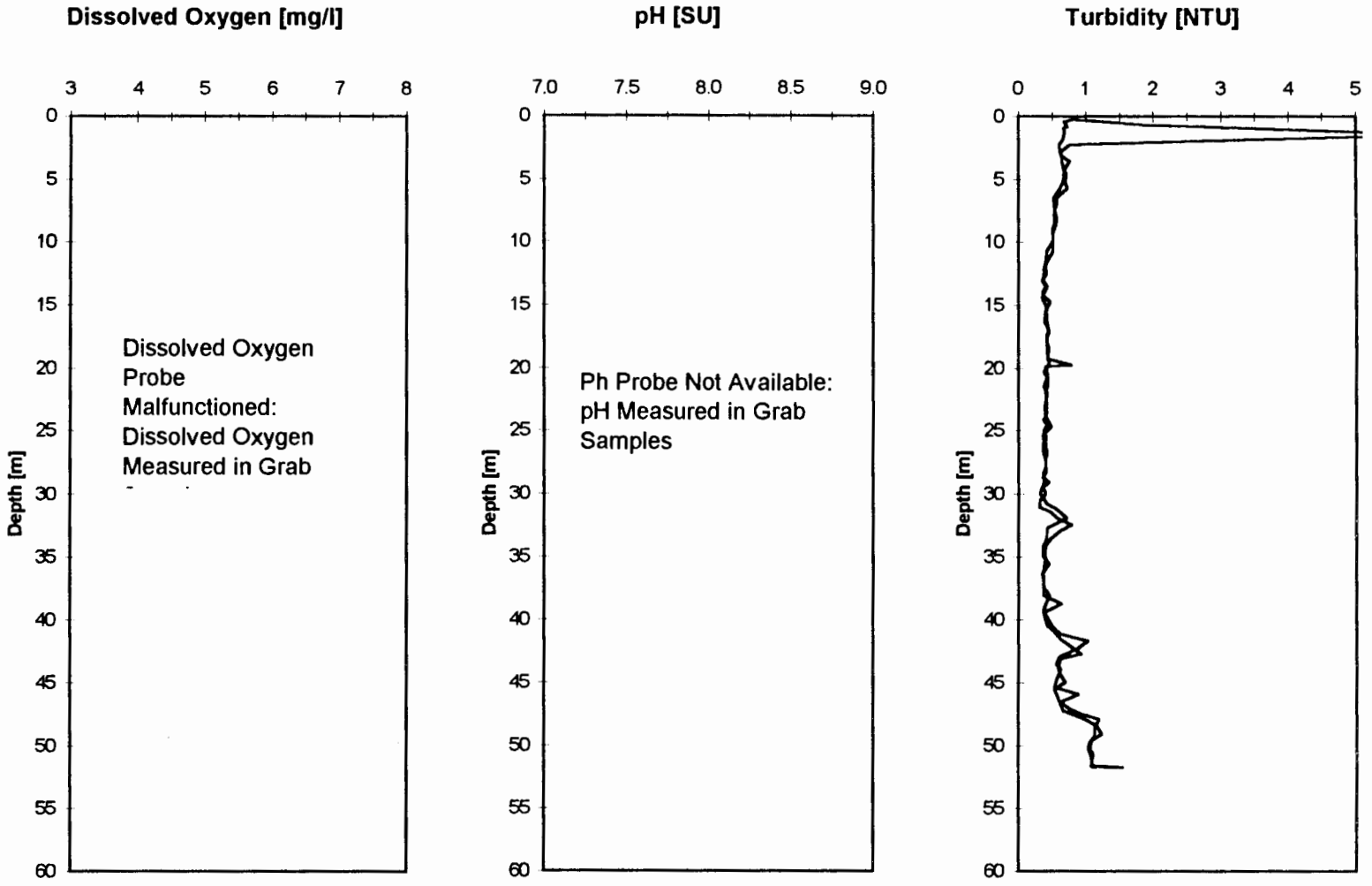
Station 9A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



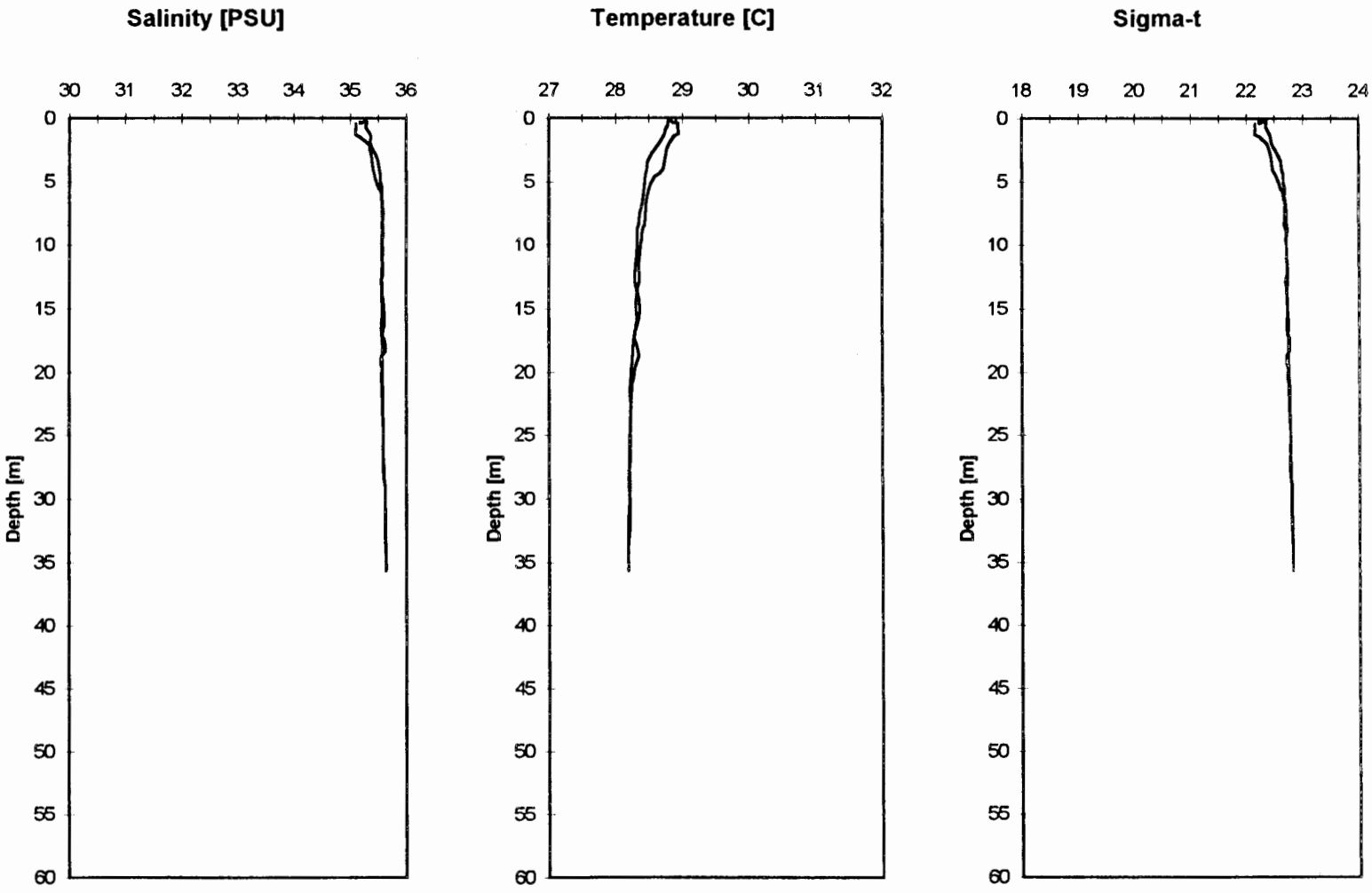
Station 9A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



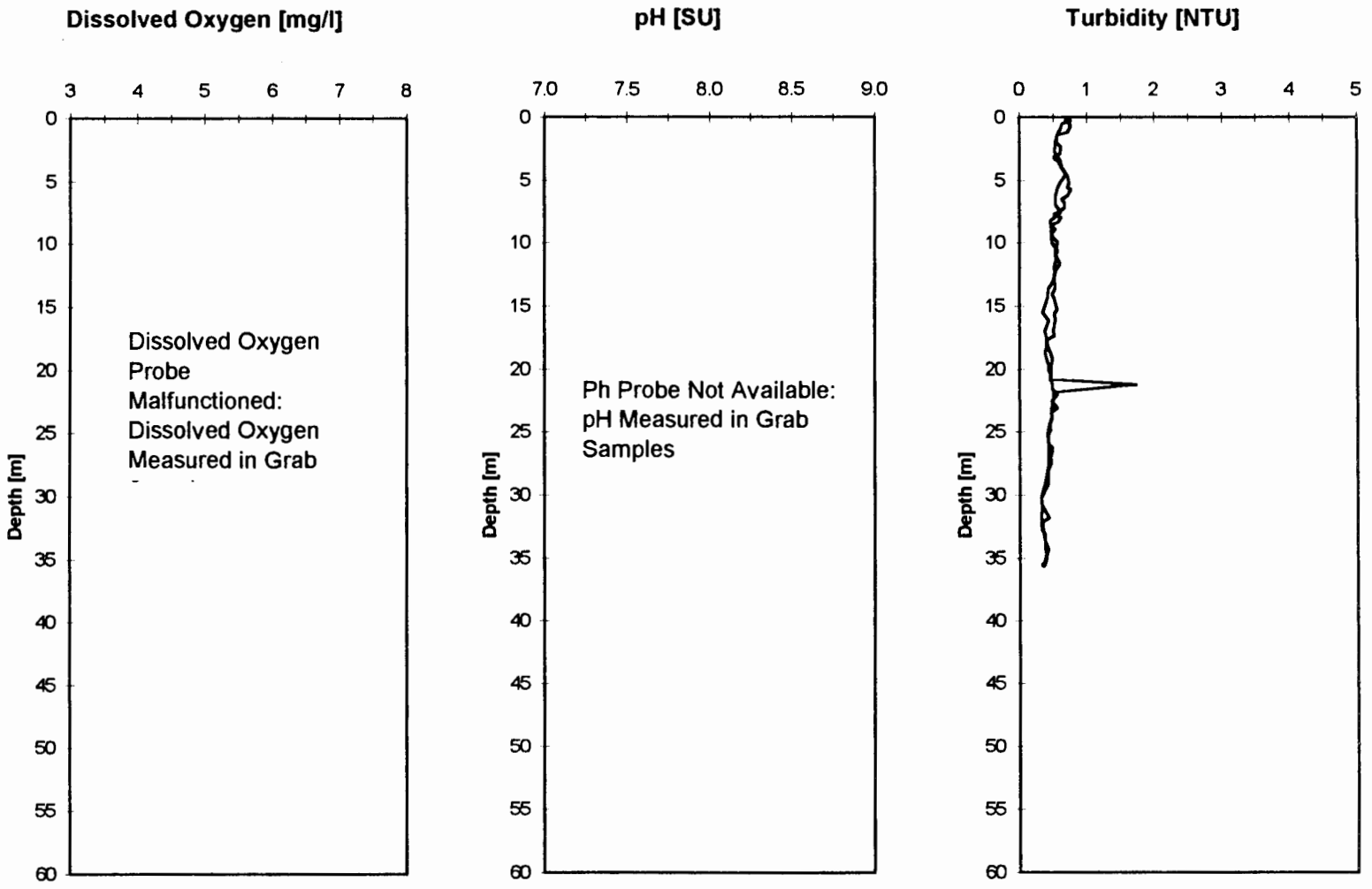
Station 10
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



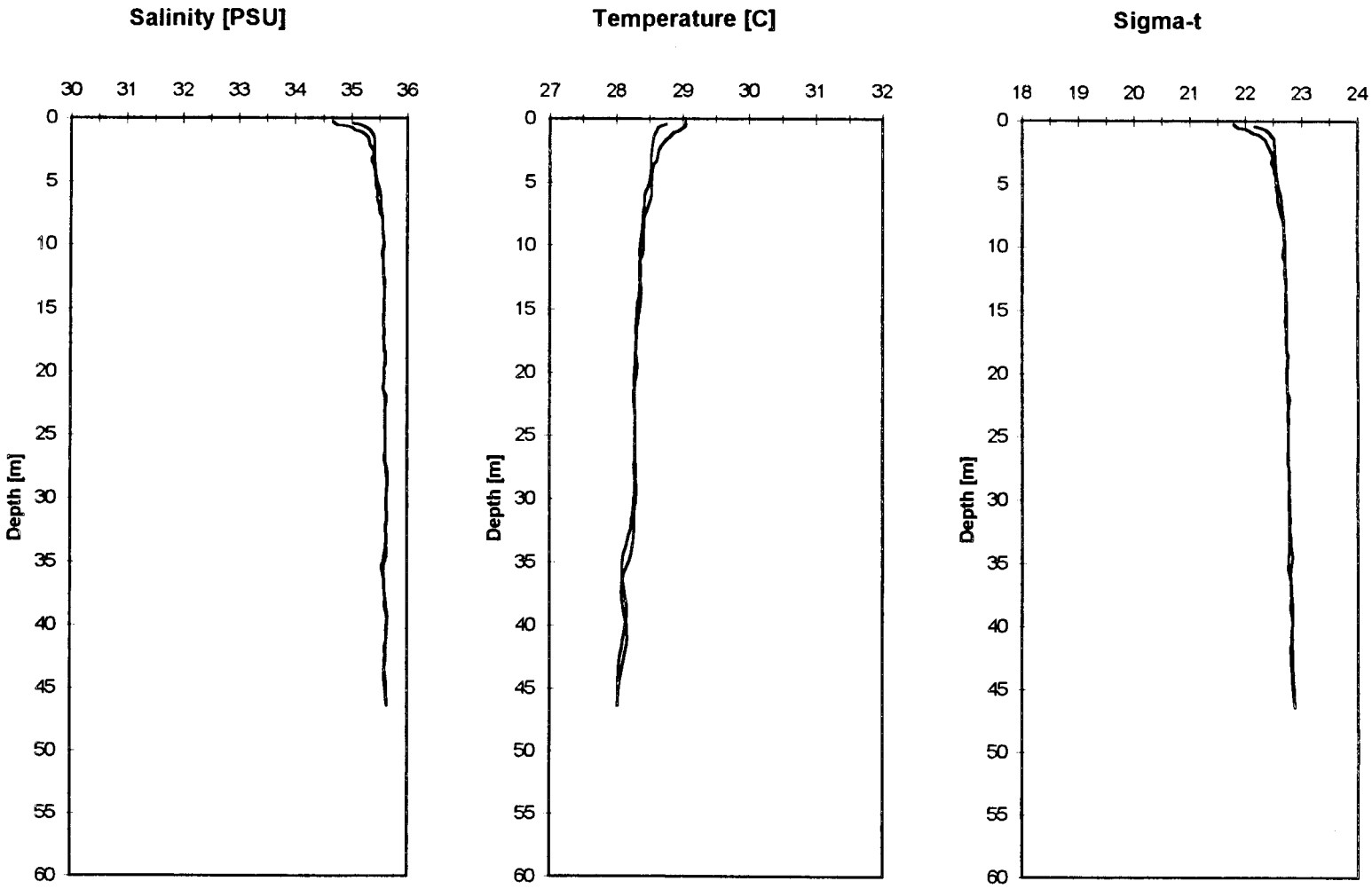
Station 10
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



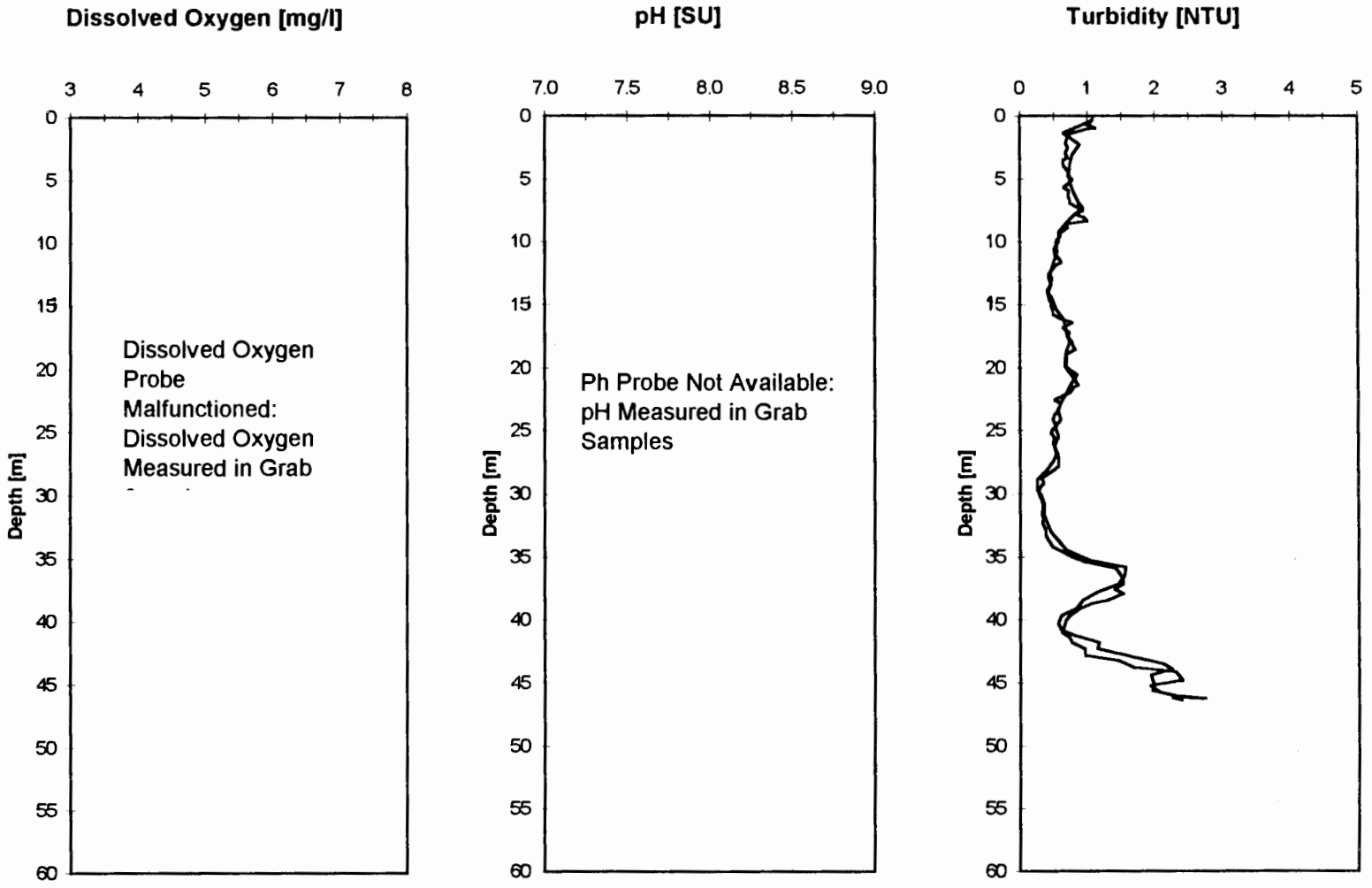
Station 10A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



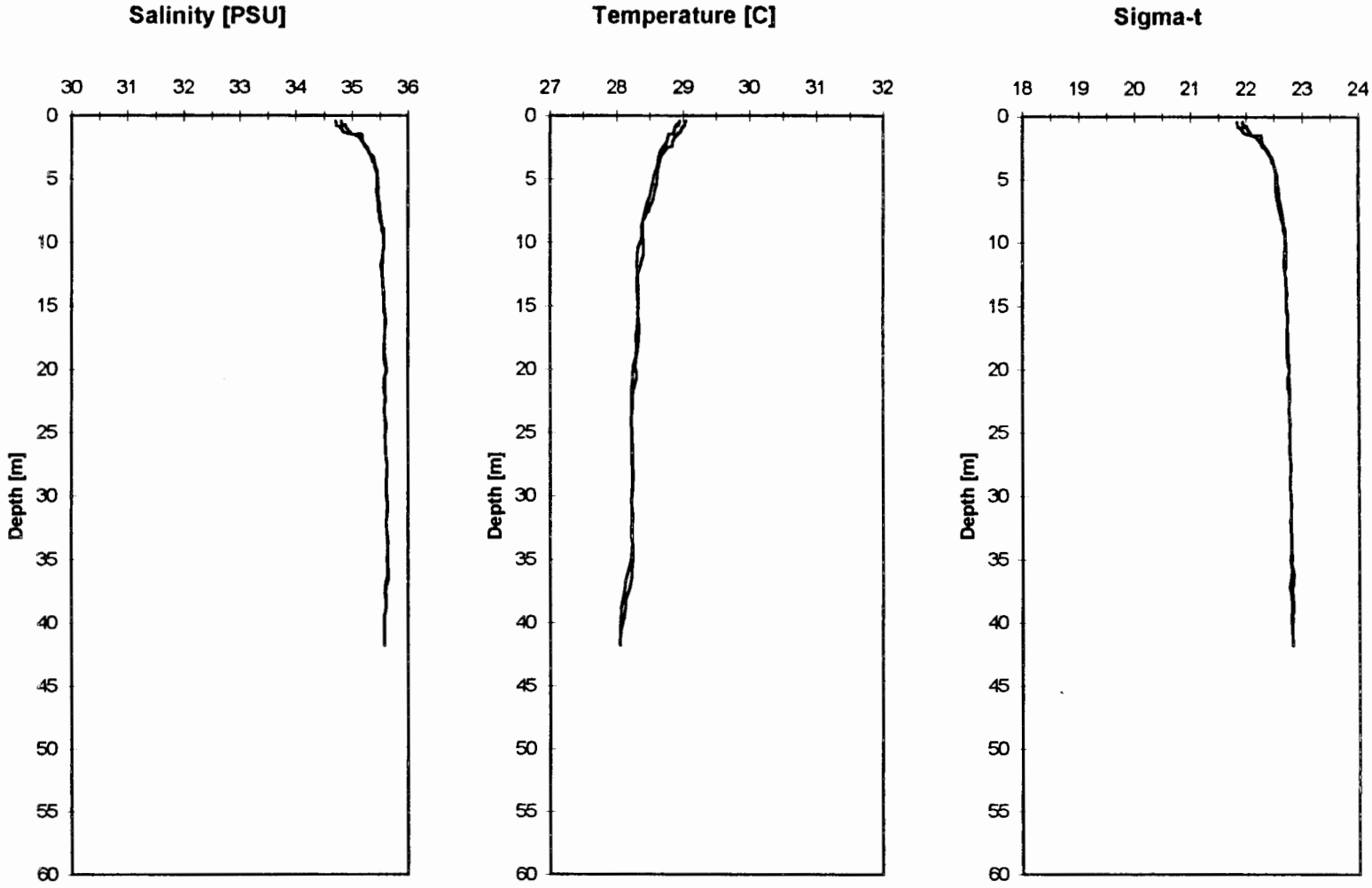
Station 10A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



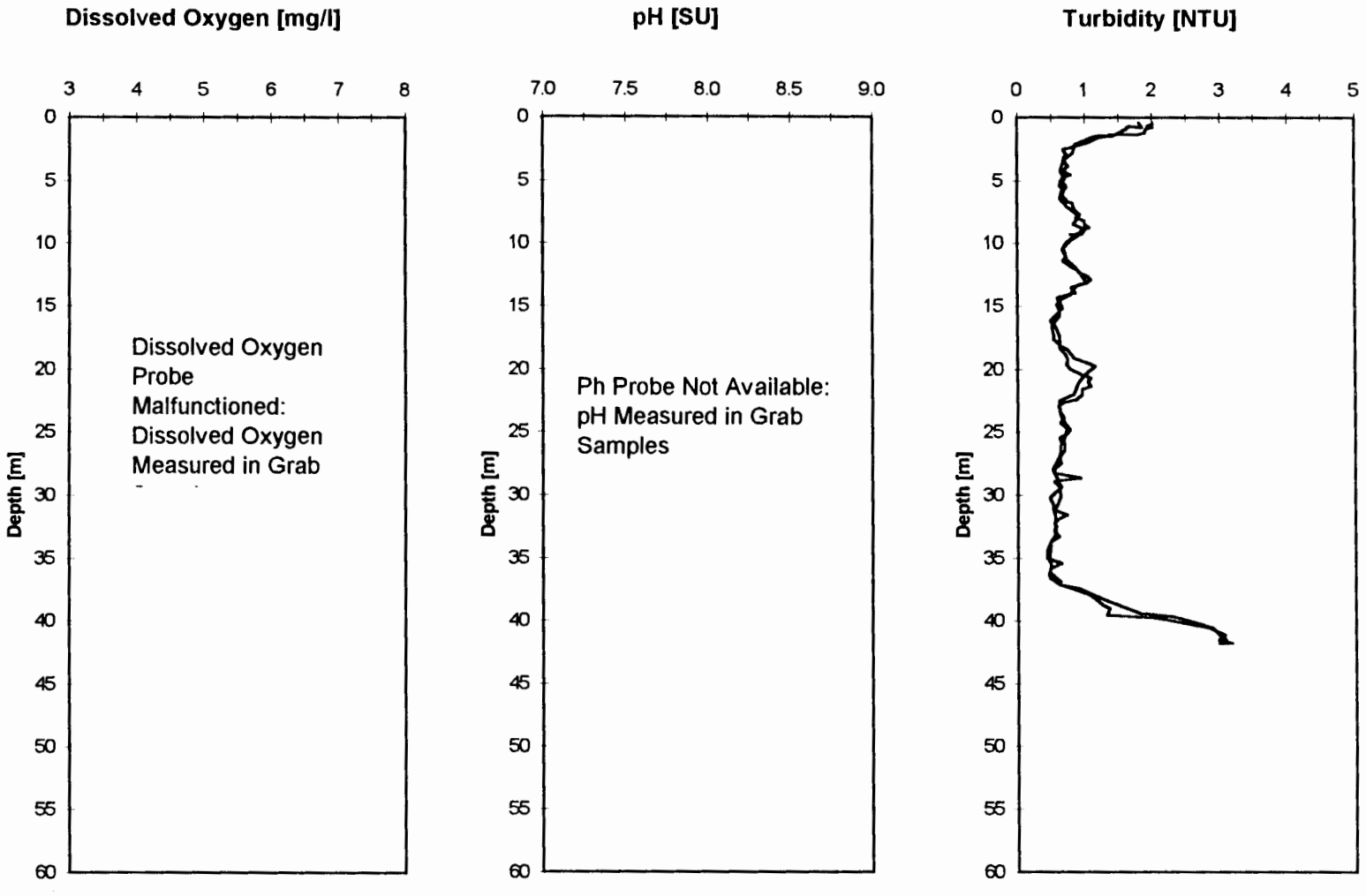
Station 11
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



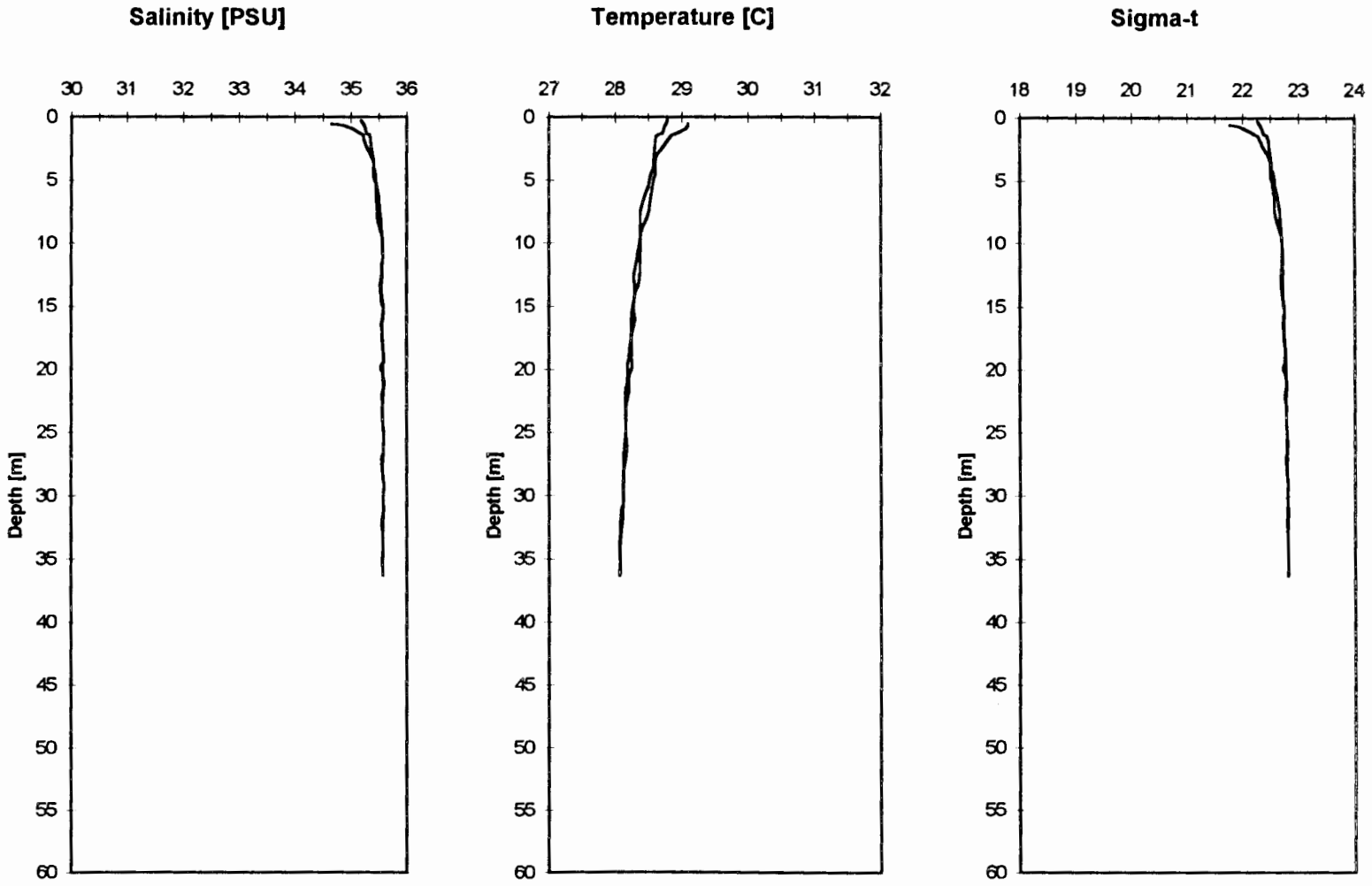
Station 11
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



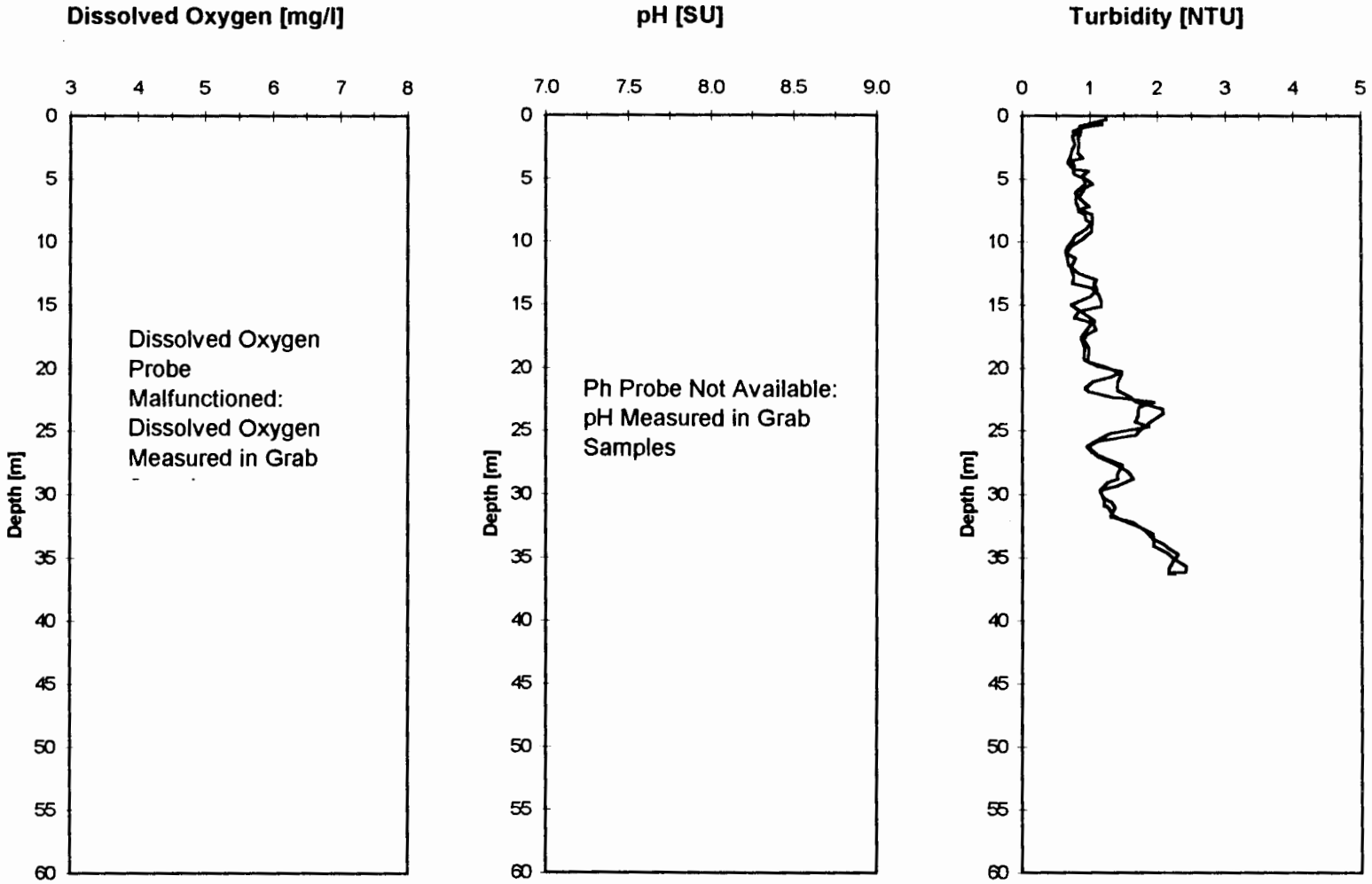
Station 11A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



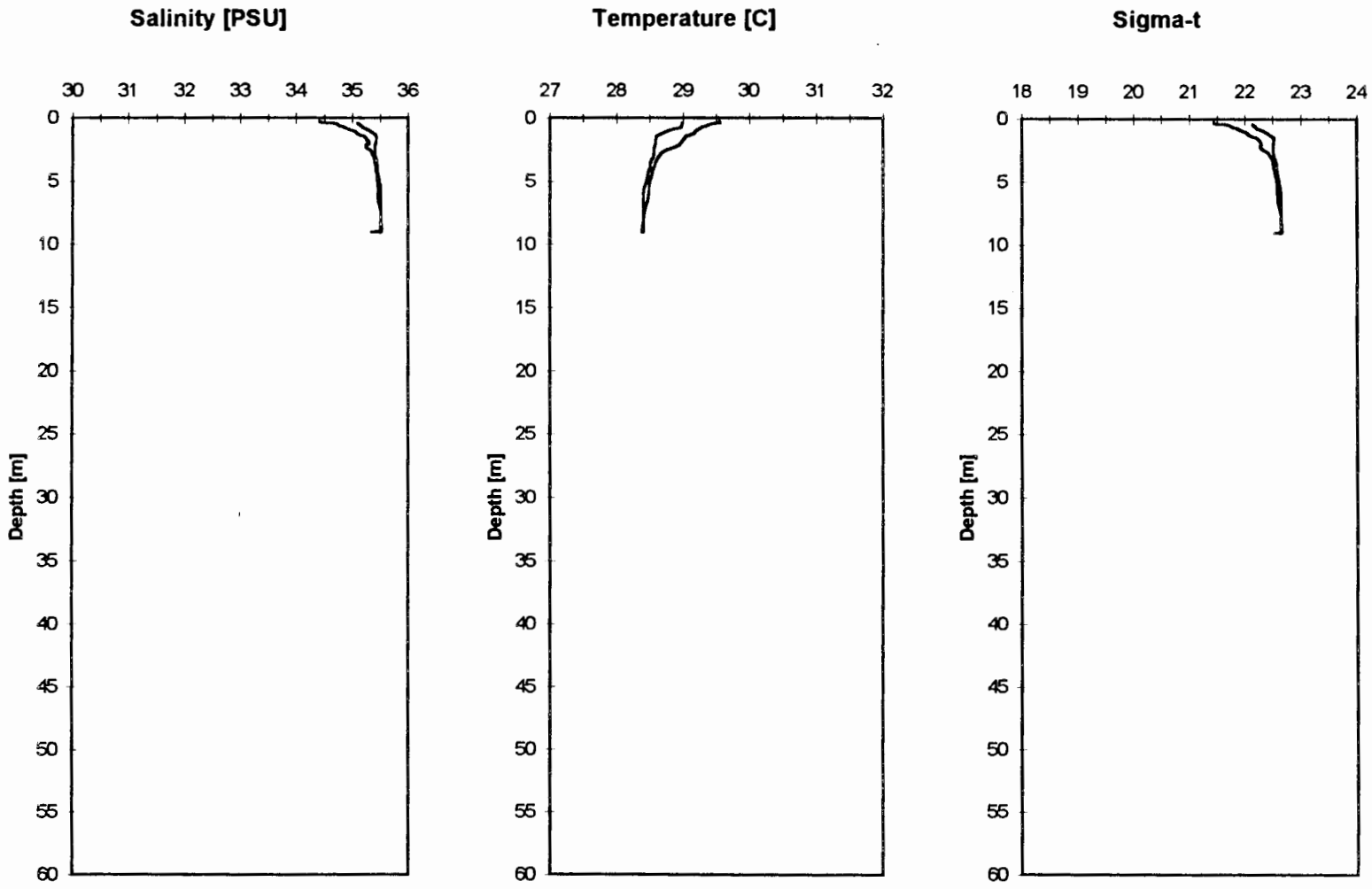
Station 11A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



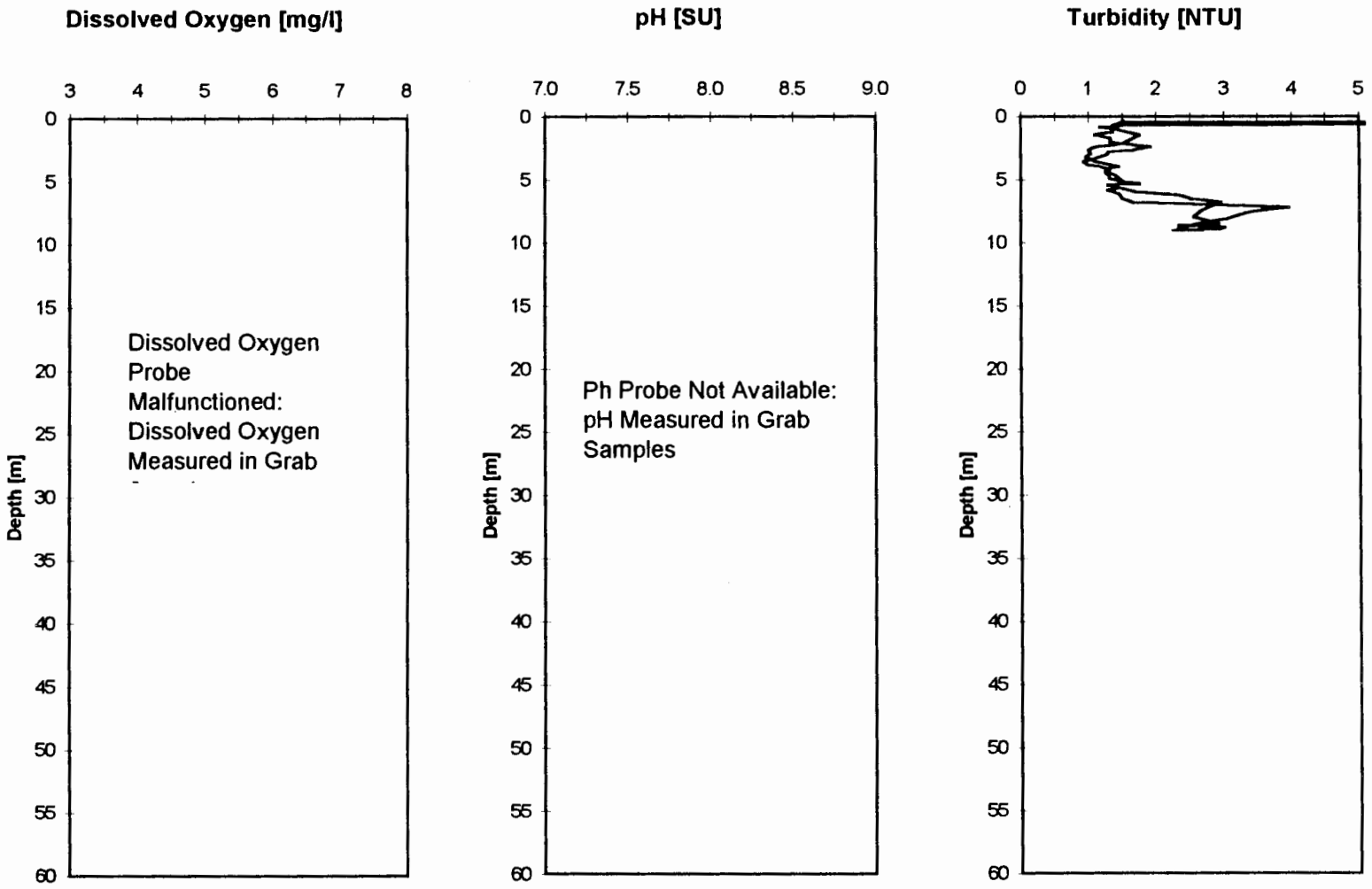
Station 12
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



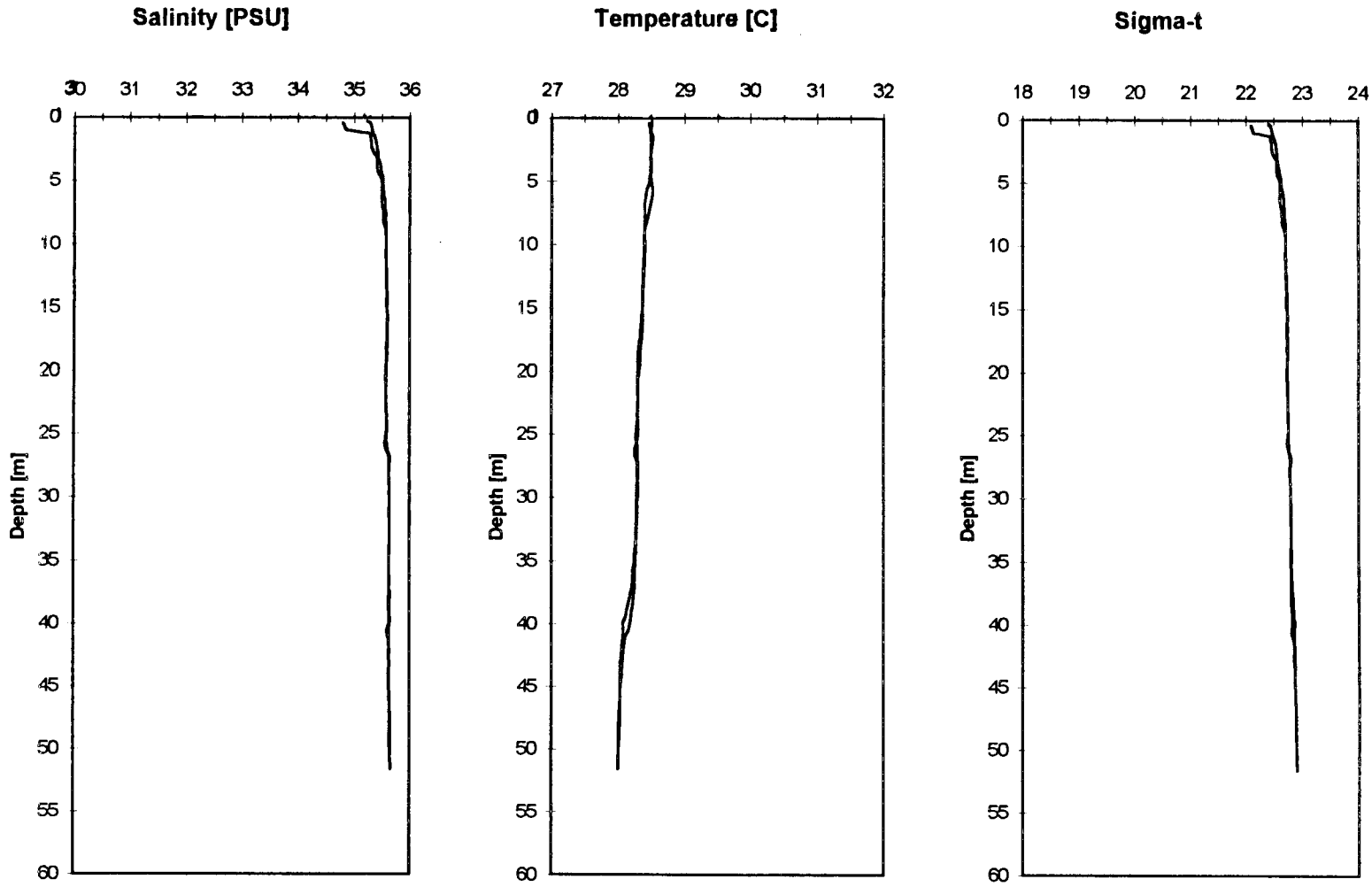
Station 12
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



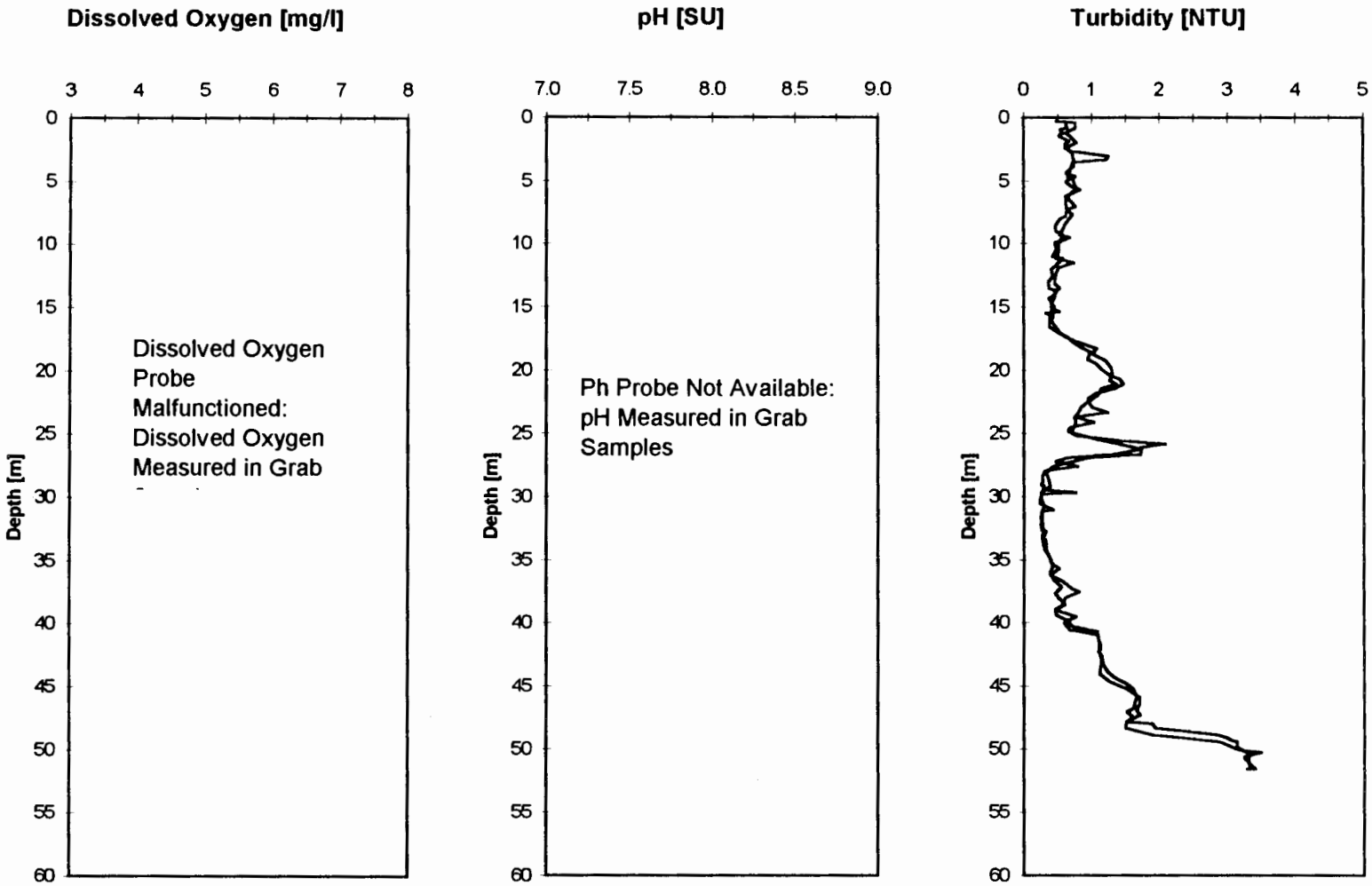
Station 13
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



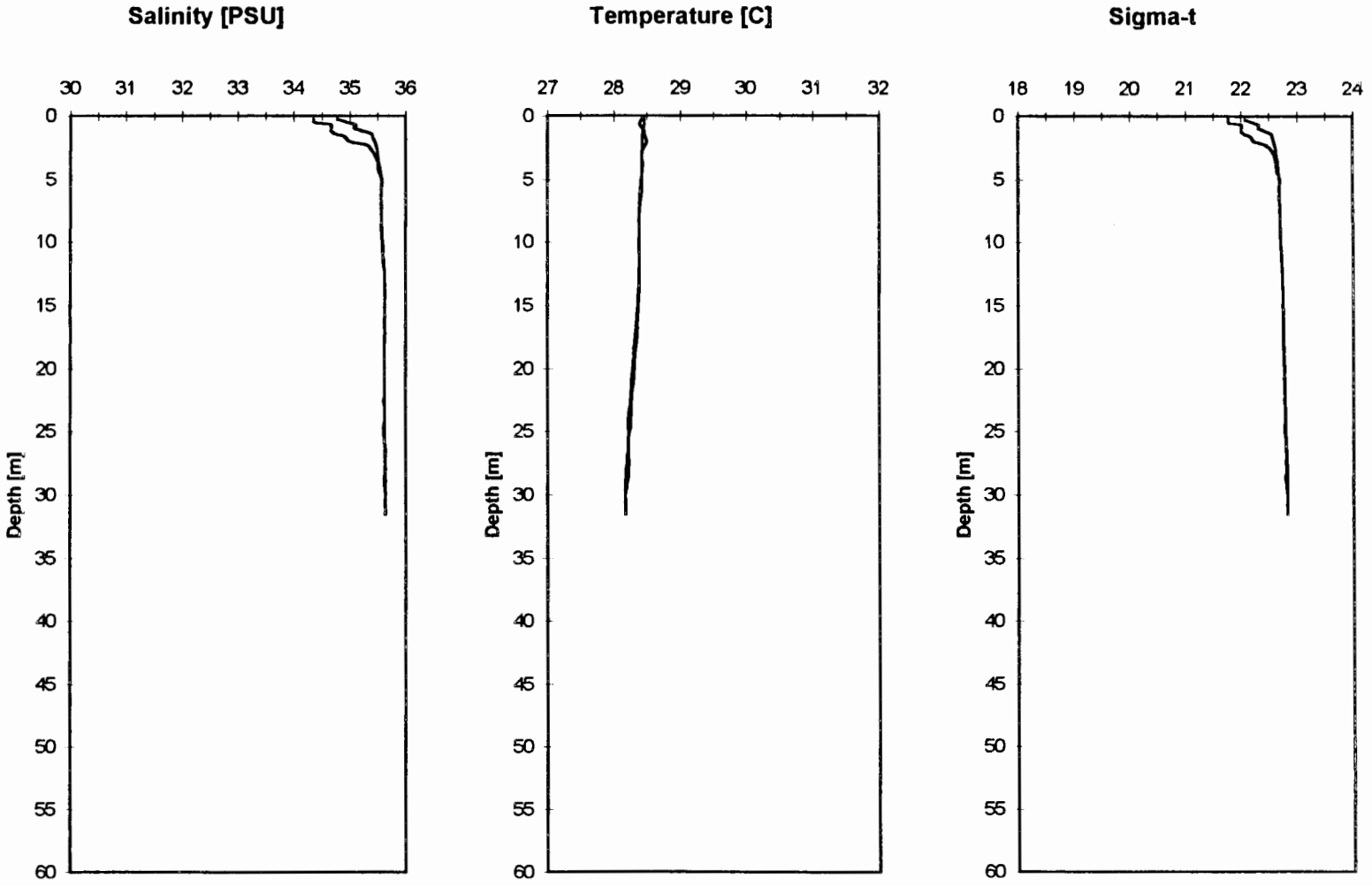
Station 13
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



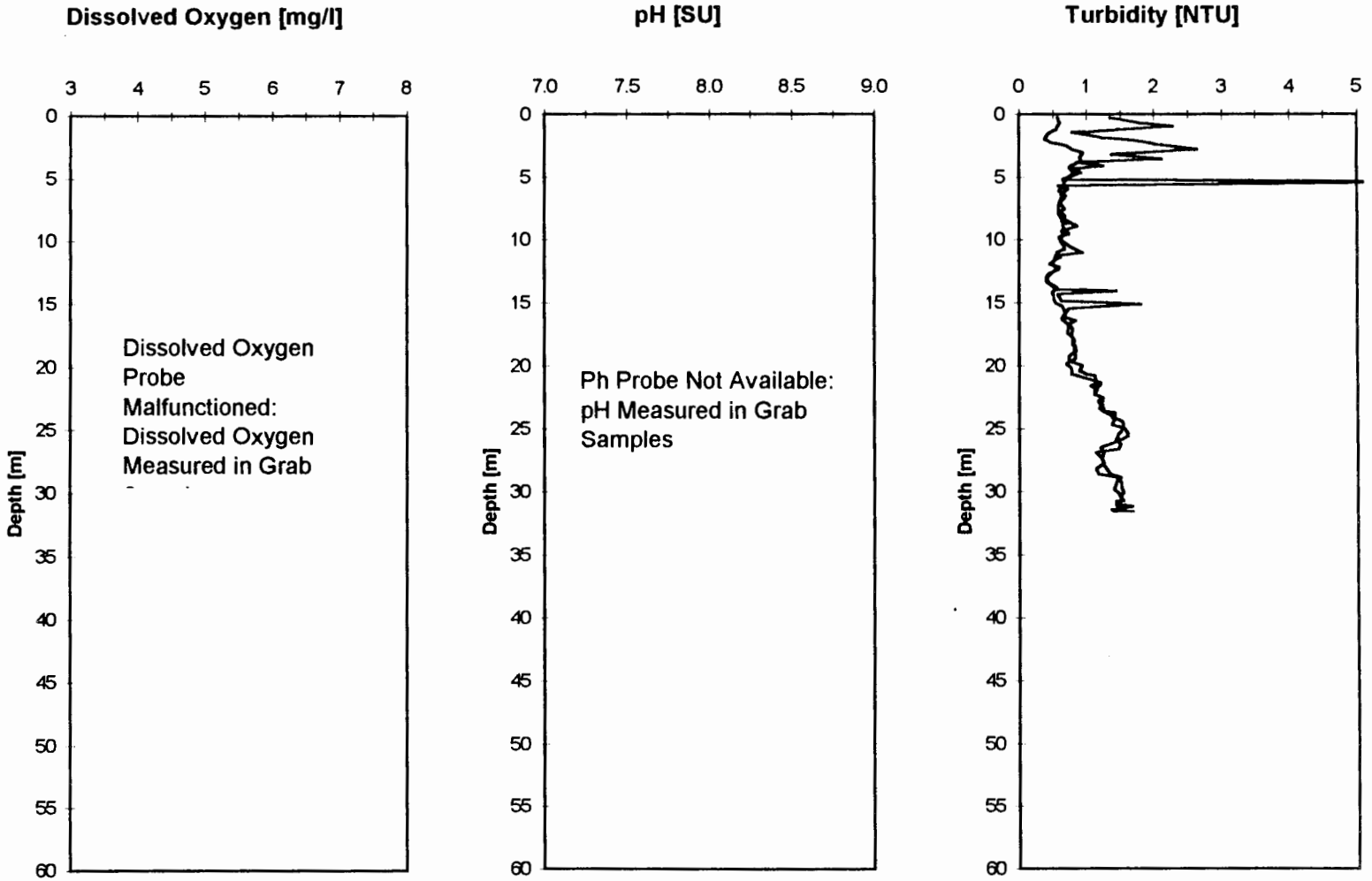
Station 14
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



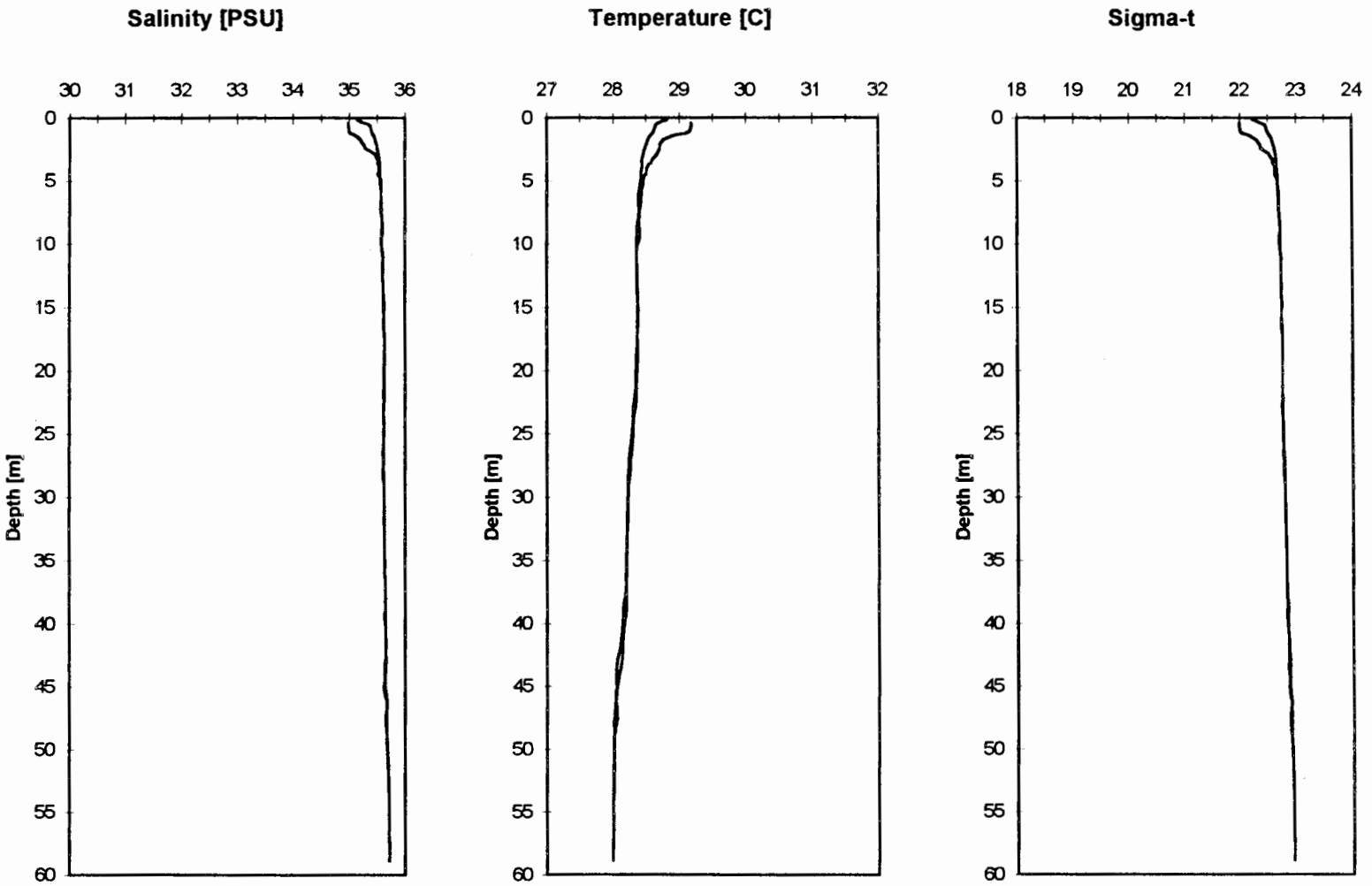
Station 14
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



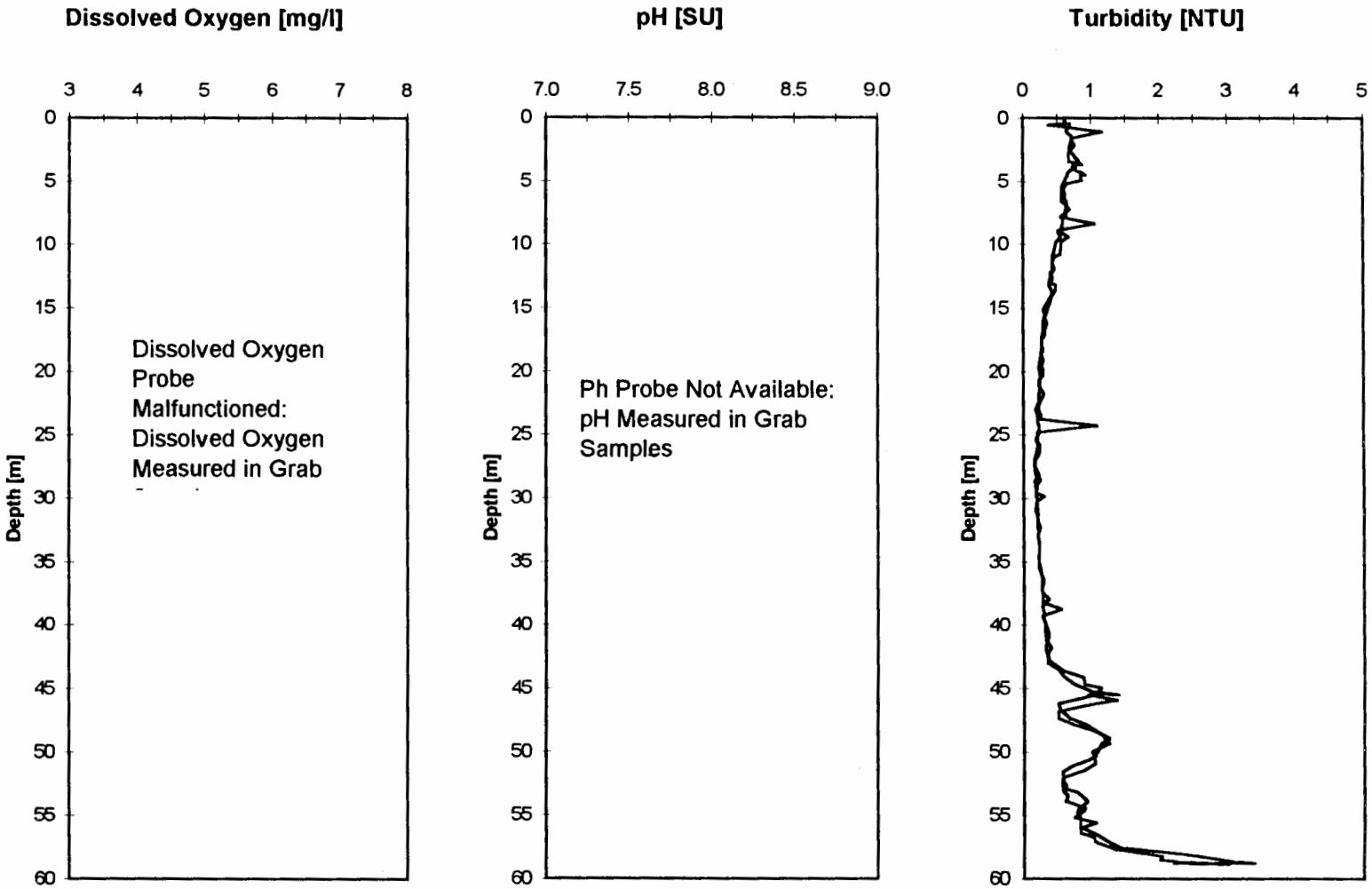
Station 15
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



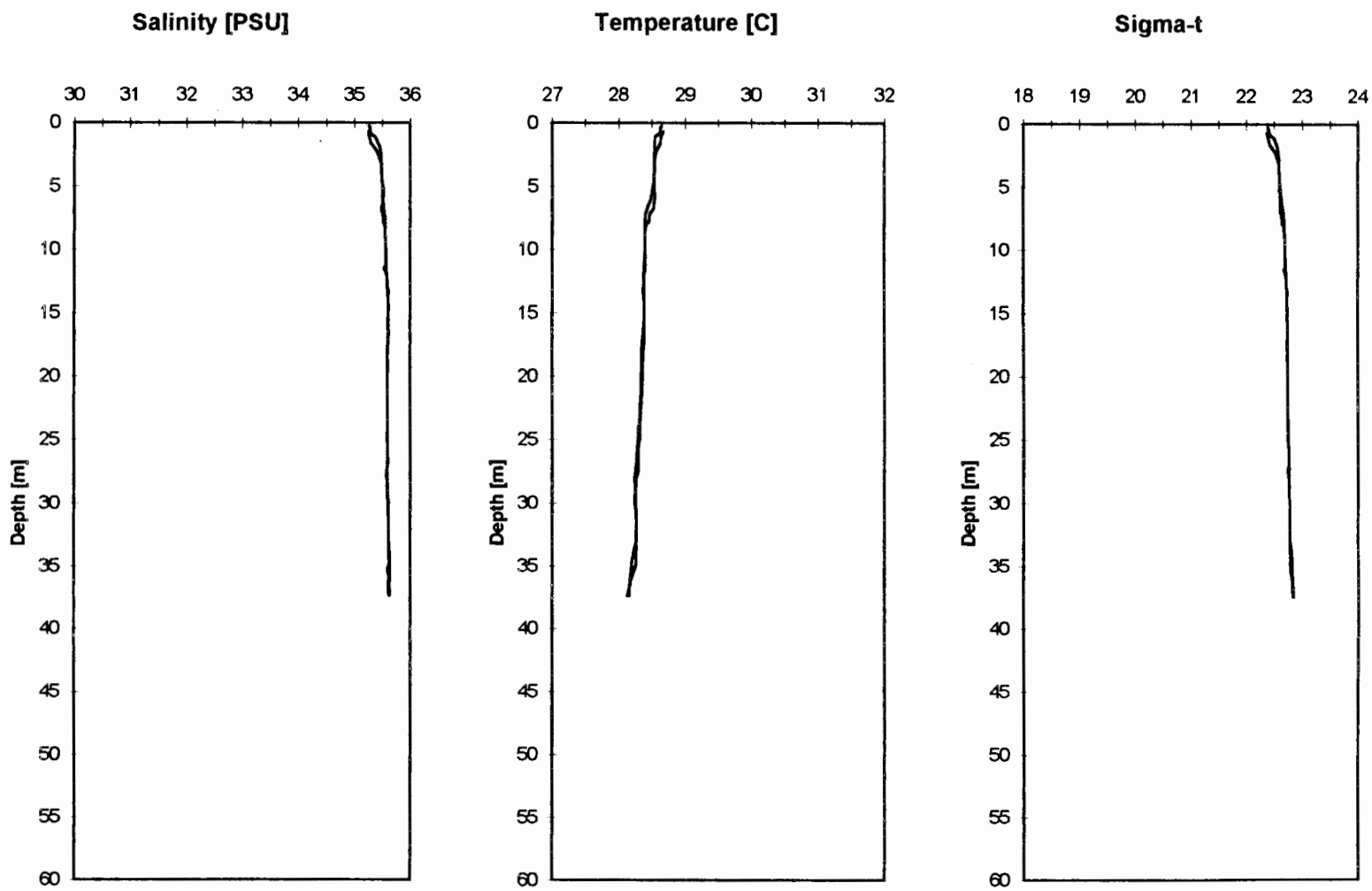
Station 15
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



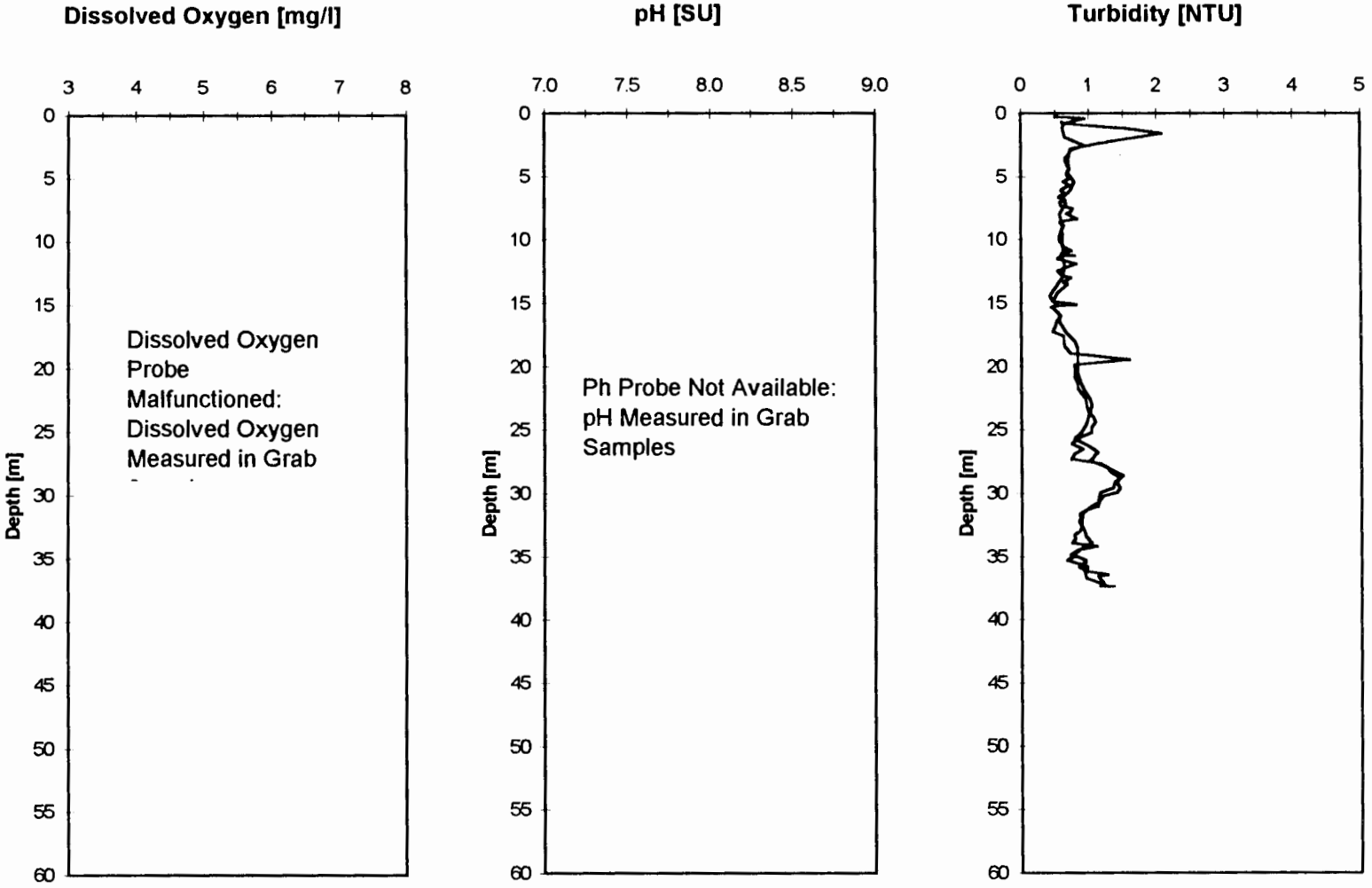
Station 16
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



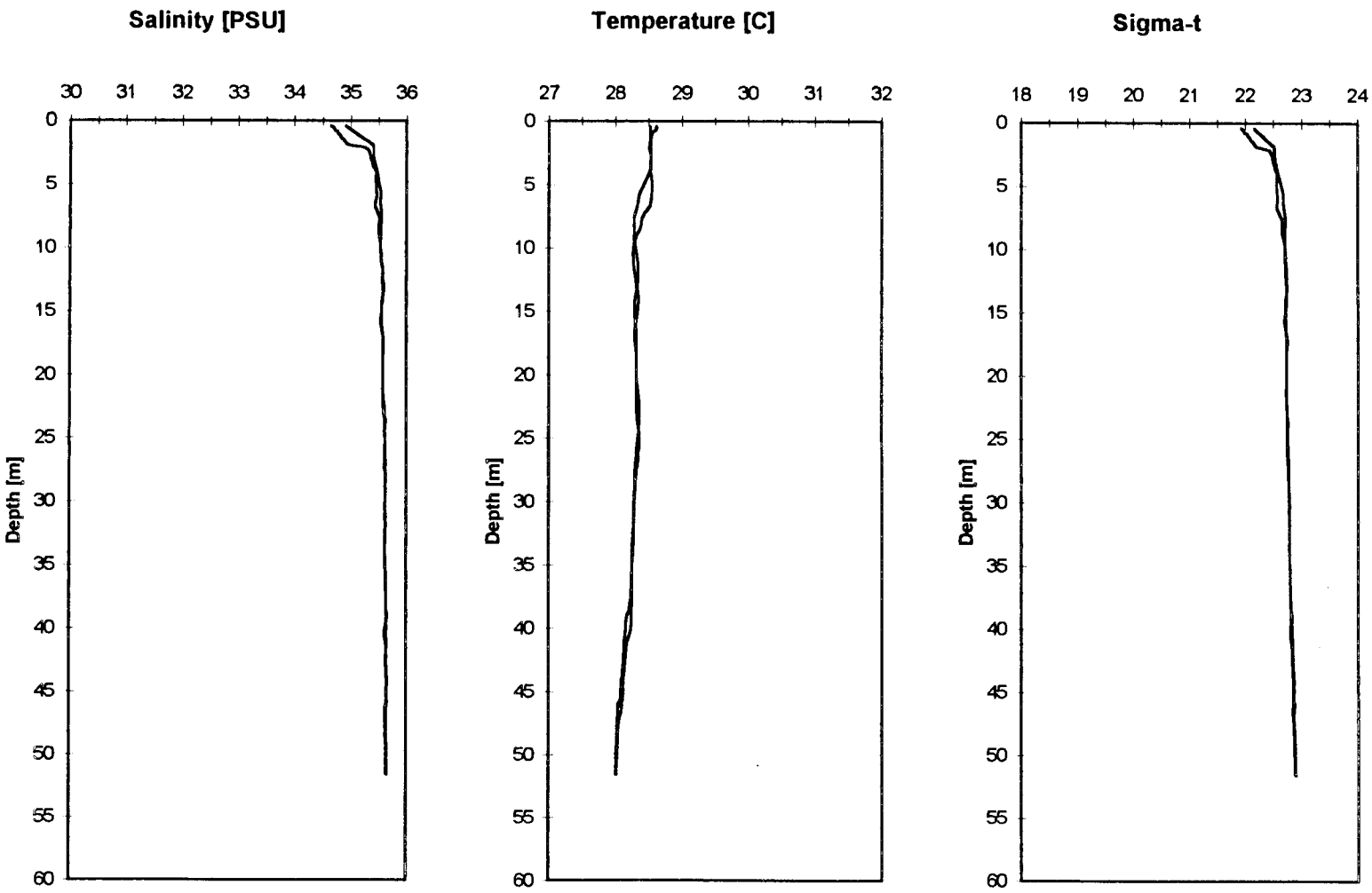
Station 16
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



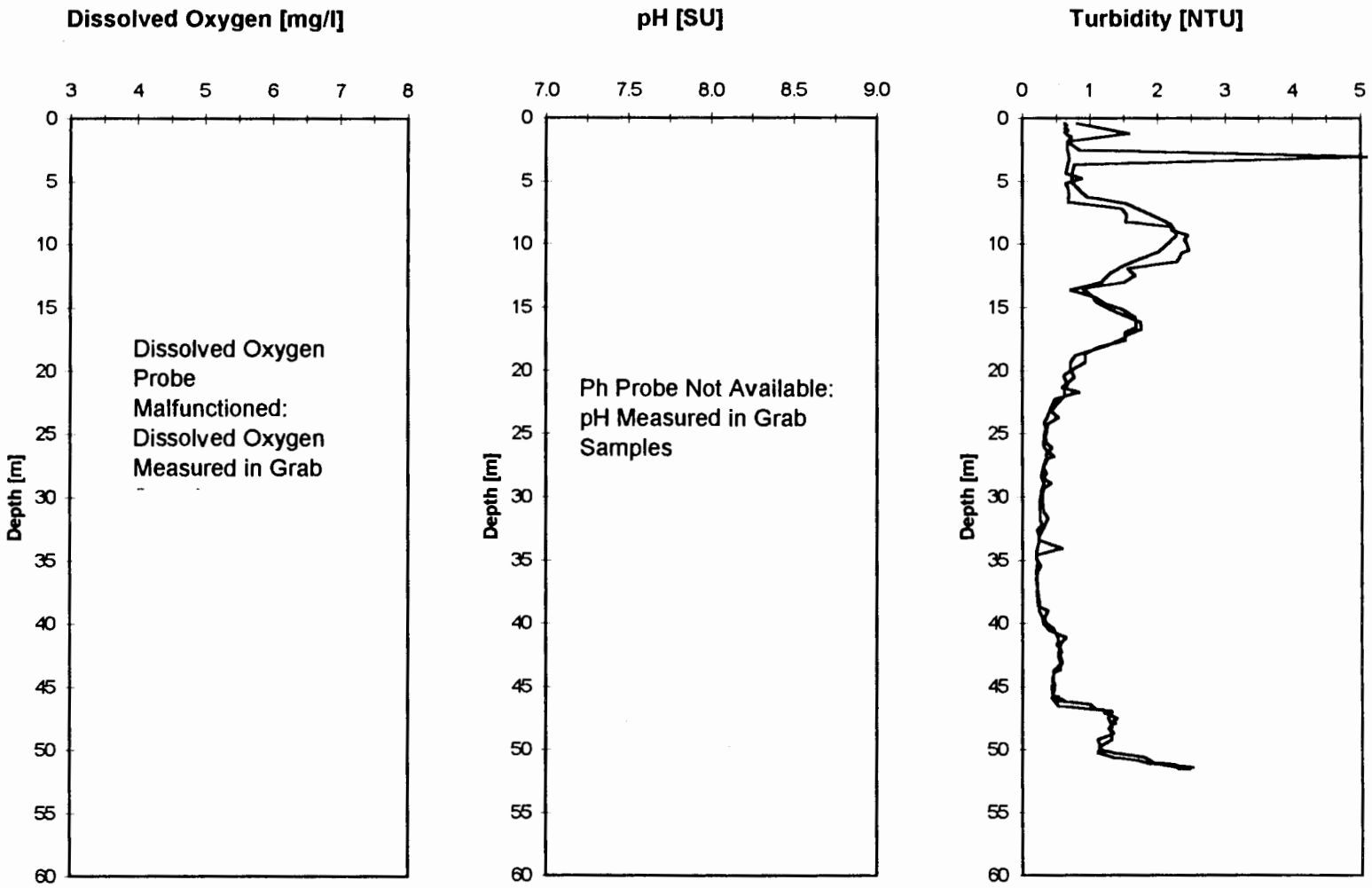
Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996

Appendix IV

Chain of Custody Records

PAGE 1 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 167091.WQ.96	Purchase Order #
Project Name: JCO HARBOR MONITORING	
Company Name/CH2M HILL Office: CH2M HILL	
Project Manager & Phone # Mr. [ ] Ms. [ ] Dr. [ ]: STEVE COSTA 707-826-0717	Report Copy to:
Requested Completion Date:	Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ___ — Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver | REMARKS | LAB 1 ID | LAB 2 ID

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED: AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHOROUS (365.2)	REMARKS
11/96				X			5-BOTM	163152	X	X	X	X	X	SEAWATER
							5-[illegible]120	316						
							5-90	317						
							5-60	318						
							5-30	319						
							5-SURF	320						
							5A-BOTM	321						
							5A-120	322						
							5A-90	323						
							5A-60	324						
							5A-30	325						

Sampled By & Title (Please sign and print name): [signature] 11/96	Date/Time	Relinquished By (Please sign and print name): [signature] 11/22/96	Date/Time
Received By (Please sign and print name): M. Brown	Date/Time: 11/25/96	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By (Please sign and print name)	Remarks: TKN @ DL of 0.05 mg/l DO NOT RUN TURBIDITY ON THESE		

QC Level: 1 2 3 Other: ___
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3.94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96

Purchase Order #

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 #; Lab 2 #; Quote #; Kit Request #; Project #; No. of Samples; Page of; Login; LIMS Ver; REMARKS; LAB 1 ID; LAB 2 ID

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @ DL of 0.05 mg/L	TOTAL PHOSPHORUS (365.2)	REMARKS
11/96				X			5A-SURF 16326	2	X	X	X	X	X	SEAWATER
							6-BOTM 327							
							6-120 328							
							6-90 329							
							6-60 330							
							6-30 331							
							6-SURF 332							
							6A-BOTM 333							
							6A-60 334							
							6A-30 335							
							6A-SURF 336							

Sampled By & Title: S.A. Costa (Please sign and print name) 11/96 — Date/Time

Received By: M. Hen (Please sign and print name) — Date/Time 11/25

Received By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Work Authorized By (Please sign and print name)

Relinquished By: S.A. Costa (Please sign and print name) 11/22/96 — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other DHL — Shipping #

QC Level: 1 2 3 Other:

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Remarks: TKN @ DL of 0.05 mg/L – NO TURBIDITY TEST ON THESE

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

QUALITY ANALYTICAL LABORATORIES, INC.

THESE SAMPLES ARE IN COOLER (WITH STATIONS 11, 11A, 12, 13

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091. WO. 96	Purchase Order #
Project Name: JCO HARBOR MONITORING	
Company Name: CH2M HILL	
Project Manager or Contact & Phone #: STEVE COSTA 707-826-7662	Report Copy to:
Requested Completion Date:	Site ID
Sample Disposal: Dispose ☐ Return ☐	

LGN
One Innovation Drive, Suite C
Alachua, FL 32615-9586
(904) 462-3050 FAX (904) 462-1670

LRD
5090 Caterpillar Road
Redding, CA 96003-1412
(916) 244-5227 FAX (916) 244-4109

LMG
2567 Fairlane Drive
Montgomery, AL 36116-1622
(334) 271-2440 FAX (334) 271-3428

LKW
Canviro Analytical Laboratories, Inc.
50 Bathurst, Unit 12
Waterloo, Ontario, Canada N2V 2C5
(519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @ DL 0.005 mg/l	TOTAL PHOSPHORUS (365.2)	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/96				X		7-BOTM 16337		2	X	X	X	X	X	SEAWATER		
						7-90 338										
						7-60 339										
						7-30 340										
↓				↓		7-SURF 341										

Sampled By & Title: S. Costa (Please sign and print name)	Date/Time 11/96	Relinquished By: S. Costa (Please sign and print name)	Date/Time 11/22/96
Received By: M. Bl (Please sign and print name)	Date/Time 11/25	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N
EDATA: Y N
QC LEVEL 1 2 3 OTHER
pH | Ice
Custody Seal | Temp

Batch Remarks: TKN DL of 0.05 mg/l DO NOT RUN TURBIDITY ON THESE SAMPLES

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96 | Purchase Order #

Project Name: JCO HARBOR MONITORING

Company Name: CH2M HILL

Project Manager or Contact & Phone #: STEVE COSTA 707-862-0717 | Report Copy to:

Requested Completion Date: | Site ID | Sample Disposal: Dispose ☐ Return ☐

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	Ammonia (350.1)	Nitrate (353.2)	Nitrite (353.2)	TKN 351.3 MDL 0.05 mg/l	Turbidity (180.1)	Total Phosphorus (365.2)	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		B-BOTTM	342	2	X	X	X	X	X	X	SEAWATER		
						B-120	343										
						B-90	344										
						B-60	345										
						B-30	346										
						B-SURF	347										
						A-BOTTM	348										
						A-120	349										
						A-90	350										
						A-60	351										
						A-30	352										

Sampled By & Title: S. Costa (Please sign and print name) — Date/Time: 11/21/96

Received By: M. Bohn (Please sign and print name) — Date/Time: 11/25/96

Received By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By: S. Costa (Please sign and print name) — Date/Time: 11/22/96

Relinquished By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Shipped Via: UPS Fed-Ex Other DHL — Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: TKN@ DL of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

PAGE 2 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 10709, ~~EL-009~~ 00196
Purchase Order #
Project Name: JCO HARBOR MONITORING
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone # — Mr. [ ] Ms. [ ] Dr. [ ]: STEVE COSTA 707-826-0717
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY
Lab 1 #: Lab 2 #:
Quote #: Kit Request #:
Project #:
No. of Samples: Page of
Login: LIMS Ver:

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ DL 0.05 mg/L (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X			9-BOTM 16354	2	X	X	X	X	X	SEAWATER		
							9-~~20~~ 90 355									
							9-60 356									
							9-30 357									
							9-SURF 358									
							9A-BOTM 359									
							9A-90 360									
							9A-60 361									
							9A-30 362									
							9A-SURF 363									

Sampled By & Time: (Please sign and print name) 11/6/96
Received By: M. BROWN (Please sign and print name) 11/25/96
Received By: (Please sign and print name)
Received By: (Please sign and print name)
Work Authorized By: (Please sign and print name)

Date/Time
Date/Time
Date/Time
Date/Time

Relinquished By: (Please sign and print name) 11/22/96
Relinquished By: (Please sign and print name)
Relinquished By: (Please sign and print name)

Date/Time
Date/Time
Date/Time

QC Level: 1 2 3 Other:
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Shipped Via: UPS BUS Fed-Ex Hand Other DHL
Shipping #:

Remarks: TKN @ DL of 0.05 mg/L — NO TURBIDITY TEST

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 2.91 FORM 219

PAGE 1 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:
Project Name: JCO HARBOR MONITORING
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ]
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY
Lab 1 #: Lab 2 #:
Quote #: Kit Request #:
Project #:
No. of Samples: Page of
Login: LIMS Ver:

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.1)	NITRITE (353.1)	TKN (351.3) @ DL of 0.05 mg/l	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/26				X			10-BOTM 1636	2	X	X	X	X	X	SEAWATER		
24							10-120 365									
46							10-90 366									
							10-60 367									
							10-30 368									
							10-SURF 369									
							10A-BOTM 370									
							10A-[redacted]90 371									
							10A-60 372									
							10A-30 373									
							10A-SURF 374									

Sampled By & Title (Please sign and print name): S R Cato — Date/Time: 11/1/96
Relinquished By (Please sign and print name): S R Cato — Date/Time: 11/1/96
Received By (Please sign and print name): M. Brow — Date/Time: 11/25/96
Relinquished By (Please sign and print name): — Date/Time:
Received By (Please sign and print name): — Date/Time:
Relinquished By (Please sign and print name): — Date/Time:
Received By (Please sign and print name): — Date/Time:
Shipped Via: UPS [ ] BUS [ ] Fed-Ex [ ] Hand [ ] Other DHL — Shipping #:
Work Authorized By (Please sign and print name):
Remarks: TKN@ DL of 0.05 mg/l — NO TURBIDITY ON THESE

QC Level: 1 2 3 Other:
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provision on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WB.-96
Purchase Order #
Project Name: JCO HARBOR MONITORING
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone #: Mr. [ ] STEVE COSTA / Ms. [ ] / Dr. [ ] 707-826-0717
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY
Lab 1 #
Lab 2 #
Quote #
Kit Request #
Project #
No. of Samples
Page of
Login
LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @ DL of 0.05 mg/L	TOTAL PHOSPHORUS 365.2	REMARKS	LAB 1 ID	LAB 2 ID
11/22/96				X			11-BOTM	1	X	X	X	X	X	SEAWATER		
							11-120									
							11-90									
							11-60									
							11-30									
							11-SURF									
							AA-BOTM									
							AA-90									
							AA-60									
							AA-30									
							AA-SURF									

Sampled By & Title: S. Costa	11/22/96	Relinquished By: S. Costa	11/22/96
Received By: M. Brown	11/25/96	Relinquished By	
Received By		Relinquished By	
Received By		Shipped Via: UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By		Remarks: TKN@DL of 0.05 mg/L DO NOT RUN TURBITY ON THESE SAMPLES	

QC Level: 1 2 3 Other:
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 2.01 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96
Purchase Order #
Project Name: JCO HARBOR MONITORING
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone # — Mr. [ ] STEVE COSTA — Ms. [ ] — Dr. [ ] 707-826-7662
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES
SHADED AREA– FOR LAB USE ONLY
Lab 1 #
Lab 2 #
Quote #
Kit Request #
Project #
No. of Samples
Page of
Login
LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED: AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/20/96				X			12-BOTM 163386	2	X	X	X	X	X	SEAWATER		
							12-30 387									
							12-SURF 388									
							13-BOTM 389									
							13-30 390									
↓				↓			13-SURF 391	↓						5 mo ↓		

Sampled By & Title (Please sign and print name): [signature] 11/20/96 — Date/Time
Received By (Please sign and print name): M. Brown — Date/Time: 11/25/96
Received By (Please sign and print name) — Date/Time
Received By (Please sign and print name) — Date/Time
Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name): [signature] 11/22/96 — Date/Time
Relinquished By (Please sign and print name) — Date/Time
Relinquished By (Please sign and print name) — Date/Time
Shipped Via: UPS BUS Fed-Ex Hand Other DHL
Shipping #

QC Level: 1 2 3 Other:
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Remarks: TKN @ DL of 0.05 mg/l — NO TURBIDITY ON THESE SAMPLES

uctio nd A men visio Rev Side -3 Bottl ted -15 125k

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV ORM

PAGE 1 OF 2

QAL QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 10791.WQ.96	Purchase Order #
Project Name JCO HARBOR MONITORING	
Company Name CH2M HILL	
Project Manager or Contact & Phone # STEVE COSTA 707-826-0717	Report Copy to:
Requested Completion Date:	Site ID
Sample Disposal: Dispose ☐ Return ☐	

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN 351.3 & DL 0.05mg/L	TOTAL PHOSPHORUS (365.2)	TURBIDITY (180.1)	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/16/96	1400			X		14-BOTM	16392	2	X	X	X	X	X	X	SEAWATER		
						14-120	393										
						14-90	394										
						14-30	396 ~~395~~										
						14-SURF	397 ~~396~~										
						15-BOTM	398										
						15-60	399										
						15-30	400										
						15-SURF	401										
						14-60	16395										
						8A-SURF	16353										

Sampled By & Title (Please sign and print name) S K Costa	Date/Time 11/21/96	Relinquished By (Please sign and print name) S K Costa	Date/Time 11/22/96
Received By (Please sign and print name) M. Brown	Date/Time 11/25/96	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER _____

pH | Ice

Custody Seal | Temp

Batch Remarks: TKN DL of 0.05 mg/L

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

QAL QUALITY ANALYTICAL LABORATORIES, INC.

PAGE 1 OF 2

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96	Purchase Order #
Project Name JCO HARBOR MONITORING	
Company Name CH2M HILL	
Project Manager or Contact & Phone # STEVE COSTA 707-826-0717	Report Copy to:
Requested Completion Date:	Site ID
Sample Disposal: Dispose ☐ Return ☐	

☐ LGN
One Innovation Drive, Suite C
Alachua, FL 32615-9586
(904) 462-3050 FAX (904) 462-1670

☐ LRD
5090 Caterpillar Road
Redding, CA 96003-1412
(916) 244-5227 FAX (916) 244-4109

☐ LMG
2567 Fairlane Drive
Montgomery, AL 36116-1622
(334) 271-2440 FAX (334) 271-3428

☐ LKW
Canviro Analytical Laboratories, Inc.
50 Bathurst, Unit 12
Waterloo, Ontario, Canada N2V 2C5
(519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ 0.05 mg/L DL 351.3	TOTAL PHOSPHORUS (365.2)	TURBIDITY 180.1	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		16-BOTM	16402	2	X	X	X	X	X	X	SEAWATER		
						16-120	403										
						16-90	404										
						16-60	16405										
						16-30	406										
						16-SURF	407										
						17-BOTM	408										
						17-30	409										
						17-SURF	410										
						18-BOTM	411										
						18-120	412										

Sampled By & Time (Please sign and print name)	11/21/96	Relinquished By (Please sign and print name)	22Nov96
Received By M. Bloom (Please sign and print name)	11/25/96	Relinquished By (Please sign and print name)	
Received By (Please sign and print name)		Relinquished By (Please sign and print name)	
Received By (Please sign and print name)		Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N
EDATA: Y N
QC LEVEL 1 2 3 OTHER _____
pH | Ice
Custody Seal | Temp

Batch Remarks: TKN DL of 0.05 mg/L

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 5/95 LAB FORM 340

Page 20 of

QAL ITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.EL.WS	Purchase Order #
Project Name: JCO HARBOR MONITORING	
Company Name: CH2M HILL	
Project Manager or Contact & Phone #: STEVE COSTA 707-826-7662	Report Copy to:
Requested Completion Date:	Site ID
Sample Disposal: Dispose ☐ Return ☐	

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (351.2)	TKN 351.3 @DL 0.05 mg/L	TOTAL PHOSPHORUS (365.2)	TURBIDITY (180.1)	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/24/96				X		1B-90	16413	2	X	X	X	X	X	X	SEAWATER		
						1B-60	4114										
						1B-30	415										
						1B-SURF	416										

Sampled By & Title (Please sign and print name)	Date/Time 20/22 Nov 96	Relinquished By (Please sign and print name)	Date/Time 22 Nov 96
Received By (Please sign and print name) M. Brown	Date/Time 11/25/96	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER _____

pH | Ice

Custody Seal | Temp

Batch Remarks: TKN DL @ 0.05 mg/L

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96

Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] STEVE COSTA; Ms. [ ]; Dr. [ ] 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 #

Quote # | Kit Request #

Project #

No. of Samples | Page of

Login | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYL-A	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			6-BOTM	1	X			
							6-120					
							6-90					
							6-60					
							6-30					
							6-SURF					
							6A-BOTM					
							6A-60					
							6A-30					
							6A-SURF					
							7-BOTM					

Sampled By & Title (Please sign and print name) | Date/Time

Received By (Please sign and print name) D. Wilson | Date/Time 11/25/96 1200

Received By (Please sign and print name) M Brown | Date/Time 11 27

Received By (Please sign and print name) | Date/Time

Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name) S Costa | Date/Time 11/25/96

Relinquished By (Please sign and print name) | Date/Time 11/27/96 1020

Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Remarks

QC Level: 1 2 3 Other:

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3.94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96 | Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] STEVE COSTA Ms. [ ] Dr. [ ] 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	LAB TEST CODES / ANALYSES REQUESTED: CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			7-90	1	X			
							7-60					
							7-30					
							7-SURF					
							8-BOTM					
							8-120					
							8-90					
							8-60					
							8-30					
							8-SURF					
							8A-BOTM					

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampled By & Title (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) S R Costa 11/25/96 | Date/Time

Received By (Please sign and print name) D. Wilson | Date/Time 11/25/96 1200

Relinquished By (Please sign and print name) D. Wilson 11/27/96 | Date/Time 1020

Received By (Please sign and print name) M. Boron | Date/Time 11/27

Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Work Authorized By (Please sign and print name)

Remarks

QC Level: 1 2 3 Other: _____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3.94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

TAG # 3-7.10

CH2M Hill Project # 107091.WQ.96

Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #
Mr. [ ] STEVE COSTA
Ms. [ ]
Dr. [ ] 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 #

Quote # | Kit Request #

Project #

No. of Samples | Page of

Login | LIMS Ver

REMARKS | LAB 1 ID | LAB 2 ID

ANALYSES REQUESTED: Chlorophyll-a

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a
11/20-23/96			X	X			BA-120	1	X
							BA-90		
							BA-60		
							BA-30		
							BA-SURF		
							9-BOTM		
							9-[redacted]90		
							9-60		
							9-30		
							9-SURF		
							9A-BOTM		

Sampled By & Title (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) S. Costa 11/25/96 | Date/Time

Received By (Please sign and print name) M.P. Nelson | Date/Time 11/25/96 1200

Relinquished By (Please sign and print name) M.P. Nelson 11/27/96 | Date/Time 1020

Received By (Please sign and print name) M. Brown | Date/Time 11/27

Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Work Authorized By (Please sign and print name)

Remarks

QC Level: 1 2 3 Other: _____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96 | Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] STEVE COSTA; Ms. [ ] ~~JEAN~~; Dr. [ ] ~~JOE~~ 8260717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a
11/20-23/96			X	X			9A-90	1	X
							9A-60		
							9A-30		
							9A-SURF		
							10-BOTM		
							10-120		
							10-90		
							10-60		
							10-30		
							10-SURF		
							10A-BOTM		

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 #

Quote # | Kit Request #

Project #

No. of Samples | Page of

Login | LIMS Ver

REMARKS | LAB 1 ID | LAB 2 ID

Sampled By & Title (Please sign and print name) | Date/Time

Received By (Please sign and print name) M. Wilson | Date/Time 11/25/96 1200

Received By (Please sign and print name) M. Boron | Date/Time 11/27

Received By (Please sign and print name) | Date/Time

Work Authorized By (Please sign and print name) | Remarks

Relinquished By (Please sign and print name) | Date/Time 11/26/96

Relinquished By (Please sign and print name) M. Wilson | Date/Time 11/27/96 1020

Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

QC Level: 1 2 3 Other: _____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

IMG Soft (?)

CH2M Hill Project # 107091.00.96

Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Steve Costa, Ms. [ ], Dr. [ ] 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-A

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 #

Quote # | Kit Request #

Project #

No. of Samples | Page of

Login | LIMS Ver

REMARKS | LAB 1 ID | LAB 2 ID

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-A
11/20-23/96			X	X			10A-90	1	X
							10A-60		
							10A-30		
							10A-SURF		
							11A-BOTM		
							11A-90		
							11A-60		
							11A-30		
							11A-SURF		
							12[redacted]-BOTM		
							12-30		

Sampled By & Title (Please sign and print name) | Date/Time

Received By: M.P. Wilson (Please sign and print name) | Date/Time: 11/25/96 1200

Received By: M. Bolon (Please sign and print name) | Date/Time: 11/27

Received By (Please sign and print name) | Date/Time

Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name): [signature] | Date/Time: 11/25/96

Relinquished By (Please sign and print name): M.P. Wilson | Date/Time: 11/27/96 1020

Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Remarks

QC Level: 1 2 3 Other:

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2MHill

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96	Purchase Order #
Project Name: HARBOR WATER QUALITY	
Company Name/CH2M HILL Office: CH2M HILL	
Project Manager & Phone # Mr. [ ] Ms. [ ] Dr. [ ]: STEVE COSTA 707-826-0717	Report Copy to:
Requested Completion Date:	Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ] — Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #	Lab 2 #
Quote #	Kit Request #
Project #	
No. of Samples	Page of
Login	LIMS Ver

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			12-SURF	1	X			
							14-BOTM					
							14-120					
							14-90					
							14-60					
							14-30					
							14-SURF					
							17-BOTM					
							17-30					
							17-SURF					
							5-BOTM					

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) S. Costa	11/25/96	Date/Time
Received By (Please sign and print name) M.P. Wilson	Date/Time 11/25/96 1200	Relinquished By (Please sign and print name) M.P. Wilson	11/27/96	Date/Time 1020
Received By (Please sign and print name) M. Brown	Date/Time 11/27	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other HAND		Shipping #
Work Authorized By (Please sign and print name)	Remarks			

QC Level: 1 2 3 Other: _____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

PAGE 1 of 1

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WB.96

Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #
Mr. [ ] STEVE COSTA
Ms. [ ]
Dr. [ ] 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ]

Sample Disposal: Dispose [ ] Return [ ]

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLORDPHYL-a
11/20-23/96			X	X			5-120	1	X
							5-90		
							5-60		
							5-30		
							5-SURF		
							5A-BOTM		
							5A-120		
							5A-90		
							5A-60		
							5A-30		
							5A-SURF		

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #

Lab 2 #

Quote #

Kit Request #

Project #

No. of Samples

Page of

Login

LIMS Ver

REMARKS

LAB 1 ID

LAB 2 ID

Sampled By & Title (Please sign and print name)

Date/Time

Relinquished By (Please sign and print name) 11/25/96

Date/Time

Received By (Please sign and print name) M. Wilson

Date/Time 11/25/96 1200

Relinquished By (Please sign and print name) M. Wilson 11/27/96

Date/Time 1030

Received By (Please sign and print name) M. Brown

Date/Time 11/27

Relinquished By (Please sign and print name)

Date/Time

Received By (Please sign and print name)

Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND

Shipping #

Work Authorized By (Please sign and print name)

Remarks

QC Level: 1 2 3 Other:

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96	Purchase Order #
Project Name: HARBOR WATER QUALITY	
Company Name/CH2M HILL Office: CH2M HILL	
Project Manager & Phone # Mr. [ ] STEVE COSTA Ms. [ ] 707-826-0717 Dr. [ ]	Report Copy to:
Requested Completion Date:	Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL a
11/20-23/96			X	X			11-BOTM	1	X
							11-120		
							11-90		
							11-60		
							11-30		
							11-SURF		
							13-BOTM		
							13-30		
							13-SURF		
							15-BOTM		
							15-60		

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY	
Lab 1 #	Lab 2 #
Quote #	Kit Request #
Project #	
No. of Samples	Page of
Login	LIMS Ver
REMARKS	LAB 1 ID / LAB 2 ID

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) S. Costa	Date/Time 11/25/96
Received By (Please sign and print name) M. Wilson	Date/Time 11/25/96 1200	Relinquished By (Please sign and print name) M. Wilson	Date/Time 11/27/96 1000
Received By (Please sign and print name) M. Brown	Date/Time 11/27	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other HAND	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96 | Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone # Mr. [ ] Ms. [ ] Dr. [ ]: STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a
11/20-23/96			X	X			15-30	1	X
							15-SURF		
							16-BOTM		
							16-120		
							16-90		
							16-60		
							16-30		
							16-SURF		
							18-BOTM		
							18-120		
							18-90		

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver | REMARKS | LAB 1 ID | LAB 2 ID

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) S. COSTA	Date/Time 11/25/96
Received By (Please sign and print name) M. Wilson	Date/Time 11/25/96 1200	Relinquished By (Please sign and print name) M. Wilson	Date/Time 11/27/96 1020
Received By (Please sign and print name) M. Brown	Date/Time 11/27	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other HAND	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/[illegible] FORM 346

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.00.96 | Purchase Order #

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717 | Report Copy to:

Requested Completion Date: | Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER [ ] | Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: CHLOROPHYLL-A

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-A	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			18-60	1	X			
							18-30					
							18-SURF					

NOTE: 102 SAMPLES TOTAL COUNT

Sampled By & Title (Please sign and print name) | Date/Time

Received By (Please sign and print name) M. Wilson | Date/Time 11/25/96 1200

Received By (Please sign and print name) M. Brown | Date/Time 11/27

Received By (Please sign and print name) | Date/Time

Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name) S. Costa | Date/Time 11/25/96

Relinquished By (Please sign and print name) M. Wilson | Date/Time 11/27/96 1020

Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Remarks

QC Level: 1 2 3 Other: _____

COC Rec | ICE

Ana Req | TEMP

Cust Seal: | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Q 078

16.5, 14.5 °C

QAL ITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96 | Purchase Order #

Project Name: JCO HARBOR W/Q STUDY

Company Name: CH2M HILL

Project Manager or Contact & Phone #: STEVE COSTA 707-826-0717

Report Copy to: David Wilson (Seattle)

Requested Completion Date: | Site ID | Sample Disposal: Dispose ☐ Return ☐

↳ 1440 Union St. Arcata, CA 95521 P.O. # 1126.648

LGN One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

LKW Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab # | Page | of

Client Service | Price Source A P Q S

Acct Code | Test Group

Project Code | Ack. Gen.

LIMS Ver | Login | Mult.

COC Review

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	ANALYSES REQUESTED: COPPER 200 SERIES	ANALYSES REQUESTED: ZINC 200 SERIES	ANALYSES REQUESTED: PER YOUR QUOTATION FOR Cu @ 2 µg/l FOR Zn @ 2 µg/l	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21				X		15-30		2	X	X		SEE BELOW		
						15-60								
						15-BOTM								
						16-30								
						16-120						(SAME 16-120)		
						16-BOTM								
						18-30								
						18-120								
						18-BOTM								

Sampled By & Title: SKCosta (Please sign and print name) Date/Time: 11/96

Received By: JASON SARA (Please sign and print name) Date/Time: 11.25.96 1600

Received By (Please sign and print name) Date/Time

Received By (Please sign and print name) Date/Time

Relinquished By: SKCosta (Please sign and print name) Date/Time: 11/22/96

Relinquished By (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) Date/Time

Shipped Via: UPS Fed-Ex Other DHL | Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: SEAWATER — HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96 | Purchase Order #

Project Name: JCO HARBOR W/Q STUDY

Company Name: CH2M HILL

Project Manager or Contact & Phone #: STEVE COSTA 707-826-0717 | Report Copy to:

Requested Completion Date: | Site ID | Sample Disposal: Dispose ☐ Return ☐

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670
☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428
☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling 1996 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	COPPER	ZINC	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21				X		5-30		2	X	X	SEE BELOW		
						5-120							
						5-BOTM							
						5A-30							
						5A-120							
						5A-BOTM							
11/20						11-30							
						11-120							
						11-BOTM							
						13-SURF							
						13-BOTM							

ANALYSES REQUESTED: PER YOUR QUOTATION FOR Cu @ 2 µg/l FOR Zn @ [illegible] µg/l

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 11/96

Received By (Please sign and print name): JASON SOUZA — Date/Time: 11.25.96 1600

Received By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name): S. Costa — Date/Time: 11/22/96

Relinquished By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Shipped Via UPS Fed-Ex Other DHL — Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: SEAWATER: HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

Appendix V

Laboratory Report for Nutrients and Biological Parameters

AMTEST

AmTest Inc
Professional Analytical Services
14603 N.E. 87th St
Redmond WA 98052
Fax 206 883 3495
Tel. 206 885 1664

ANALYSIS REPORT

CH2M Hill
PO Box 91500
Bellevue, WA 98009-2050
Attention: Steve Costa

Date Received: 11/25/96
Date Reported: 12/11/96

Project Name: JCO Harbor Mont.
Project #: 107091.WQ.96
Date Sampled: 11/21/96

Water Samples

PARAMETER	UNITS	RESULT
96-A016315		
Client ID: 5-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.013
96-A016316		
Client ID: 5-120		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.092
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.011
96-A016317		
Client ID: 5-90		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.066
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	< 0.005
96-A016318		
Client ID: 5-60		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016319		
Client ID: 5-30		
Chlorophyll a	mg/m3	0.22
Pheophytin	mg/m3	0.09
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016320		
Client ID: 5-SURF		
Chlorophyll a	mg/m3	0.25
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016321		
Client ID: 5A-BOTTOM		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.010
96-A016322		
Client ID: 5A-120		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016323		
Client ID: 5A-90		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.043
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.011
96-A016324		
Client ID: 5A-60		
Chlorophyll a	mg/m3	0.71
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.093
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.012
96-A016325		
Client ID: 5A-30		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.060
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
96-A016326		
Client ID: 5A-SURF		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.071
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.005

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016327		
Client ID: 6-BOTTOM		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.047
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.010
96-A016328		
Client ID: 6-120		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.039
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.007
96-A016329		
Client ID: 6-90		
Chlorophyll a	mg/m3	0.57
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.014
96-A016330		
Client ID: 6-60		
Chlorophyll a	mg/m3	0.96
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.029
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.009

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016331		
Client ID: 6-30		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.14
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.097
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.016
96-A016332		
Client ID: 6-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.39
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.063
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.008
96-A016333		
Client ID: 6A-BOTTOM		
Chlorophyll a	mg/m3	0.78
Pheophytin	mg/m3	0.31
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016334		
Client ID: 6A-60		
Chlorophyll a	mg/m3	1.5
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.068
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.012

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016335		
Client ID: 6A-30		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.38
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.10
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016336		
Client ID: 6A-SURF		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	0.35
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.039
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016337		
Client ID: 7-BOTTOM		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.051
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.024
96-A016338		
Client ID: 7-90		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	0.11
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.016

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016339		
Client ID: 7-60		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.26
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.016
96-A016340		
Client ID: 7-30		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.005
Total Nitrogen	mg/l	0.035
Nitrate + Nitrite	mg/l	0.012
Nitrite Nitrogen	mg/l	0.012
Total Phosphorus	mg/l	0.020
96-A016341		
Client ID: 7-SURF		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.49
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.019
96-A016342		
Client ID: 8-BOTTOM		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	< 0.01

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016343		
Client ID: 8-120		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	0.15
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.022
Turbidity	NTU	< 0.01
96-A016344		
Client ID: 8-90		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.01
96-A016345		
Client ID: 8-60		
Chlorophyll a	mg/m3	0.85
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.006
Total Nitrogen	mg/l	0.040
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.011
Total Phosphorus	mg/l	0.027
Turbidity	NTU	0.05
96-A016346		
Client ID: 8-30		
Chlorophyll a	mg/m3	2.7
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.09

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016347		
Client ID: 8-SURF		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.71
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014
Turbidity	NTU	0.10
96-A016348		
Client ID: 8A-BOTTOM		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.014
Nitrite Nitrogen	mg/l	0.022
Total Phosphorus	mg/l	0.013
Turbidity	NTU	0.07
96-A016349		
Client ID: 8A-120		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.016
Turbidity	NTU	< 0.01
96-A016350		
Client ID: 8A-90		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.03

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016351		
Client ID: 8A-60		
Chlorophyll a	mg/m3	0.96
Pheophytin	mg/m3	0.22
Ammonia Nitrogen	mg/l	0.10
Total Nitrogen	mg/l	0.17
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.008
Total Phosphorus	mg/l	0.065
Turbidity	NTU	0.27
96-A016352		
Client ID: 8A-30		
Chlorophyll a	mg/m3	1.9
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.10
Total Nitrogen	mg/l	0.15
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.062
Turbidity	NTU	0.24
96-A016353		
Client ID: 8A-SURF		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.55
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.031
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.023
Turbidity	NTU	0.11
96-A016354		
Client ID: 9-BOTTOM		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.013
Nitrite Nitrogen	mg/l	0.016
Total Phosphorus	mg/l	0.024

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016355		
Client ID: 9-90		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.008
Total Nitrogen	mg/l	0.056
Nitrate + Nitrite	mg/l	0.031
Nitrite Nitrogen	mg/l	0.029
Total Phosphorus	mg/l	0.030
96-A016356		
Client ID: 9-60		
Chlorophyll a	mg/m3	0.37
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.010
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.022
Nitrite Nitrogen	mg/l	0.030
Total Phosphorus	mg/l	0.031
96-A016357		
Client ID: 9-30		
Chlorophyll a	mg/m3	0.53
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.009
Total Nitrogen	mg/l	0.047
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.031
96-A016358		
Client ID: 9-SURF		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	0.06
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.017
Total Phosphorus	mg/l	0.022

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016359		
Client ID: 9A-BOTTOM		
Chlorophyll a	mg/m3	0.31
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.019
96-A016360		
Client ID: 9A-90		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.016
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.019
96-A016361		
Client ID: 9A-60		
Chlorophyll a	mg/m3	0.37
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.027
Total Phosphorus	mg/l	0.026
96-A016362		
Client ID: 9A-30		
Chlorophyll a	mg/m3	0.80
Pheophytin	mg/m3	0.08
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.018
Total Phosphorus	mg/l	0.022

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016363		
Client ID: 9A-SURF		
Chlorophyll a	mg/m3	0.82
Pheophytin	mg/m3	0.08
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.018
96-A016364		
Client ID: 10-BOTTOM		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014
96-A016365		
Client ID: 10-120		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.014
Total Phosphorus	mg/l	0.014
96-A016366		
Client ID: 10-90		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.030
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.012

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016367		
Client ID: 10-60		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.062
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.012
96-A016368		
Client ID: 10-30		
Chlorophyll a	mg/m3	0.69
Pheophytin	mg/m3	0.20
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.030
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.019
96-A016369		
Client ID: 10-SURF		
Chlorophyll a	mg/m3	0.74
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
96-A016370		
Client ID: 10A-BOTTOM		
Chlorophyll a	mg/m3	0.50
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.014

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016371		
Client ID: 10A-90		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.012
96-A016372		
Client ID: 10A-60		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.011
96-A016373		
Client ID: 10A-30		
Chlorophyll a	mg/m3	0.69
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.018
96-A016374		
Client ID: 10A-SURF		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.014

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016375		
Client ID: 11-BOTTOM		
Chlorophyll a	mg/m3	0.41
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.014
Nitrite Nitrogen	mg/l	0.026
Total Phosphorus	mg/l	0.019
96-A016376		
Client ID: 11-120		
Chlorophyll a	mg/m3	0.29
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.024
Total Phosphorus	mg/l	< 0.005
96-A016377		
Client ID: 11-90		
Chlorophyll a	mg/m3	0.43
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.029
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.008
Total Phosphorus	mg/l	< 0.005
96-A016378		
Client ID: 11-60		
Chlorophyll a	mg/m3	0.98
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.021
Total Phosphorus	mg/l	0.012

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016379		
Client ID: 11-30		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.09
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.011
96-A016380		
Client ID: 11-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.014
96-A016381		
Client ID: 11A-BOTTOM		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	0.10
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.037
Nitrate + Nitrite	mg/l	0.018
Nitrite Nitrogen	mg/l	0.027
Total Phosphorus	mg/l	0.016
96-A016382		
Client ID: 11A-90		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.011
Total Phosphorus	mg/l	0.011

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016383		
Client ID: 11A-60		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.13
Nitrate + Nitrite	mg/l	0.019
Nitrite Nitrogen	mg/l	0.023
Total Phosphorus	mg/l	0.011
96-A016384		
Client ID: 11A-30		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.24
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.26
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	< 0.005
96-A016385		
Client ID: 11A-SURF		
Chlorophyll a	mg/m3	1.7
Pheophytin	mg/m3	0.05
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	< 0.005
96-A016386		
Client ID: 12-BOTTOM		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	0.06
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.056
Nitrate + Nitrite	mg/l	0.027
Nitrite Nitrogen	mg/l	0.033
Total Phosphorus	mg/l	0.010

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016387		
Client ID: 12-30		
Chlorophyll a	mg/m3	1.0
Pheophytin	mg/m3	0.25
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.034
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.018
96-A016388		
Client ID: 12-SURF		
Chlorophyll a	mg/m3	1.9
Pheophytin	mg/m3	0.52
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.050
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.010
96-A016389		
Client ID: 13-BOTTOM		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.31
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.016
96-A016390		
Client ID: 13-30		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.23
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.014

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016391		
Client ID: 13-SURF		
Chlorophyll a	mg/m3	3.7
Pheophytin	mg/m3	0.64
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.070
Nitrate + Nitrite	mg/l	0.024
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.025
96-A016392		
Client ID: 14-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.038
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.021
Total Phosphorus	mg/l	0.021
Turbidity	NTU	0.11
96-A016393		
Client ID: 14-120		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.05
96-A016394		
Client ID: 14-90		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.04

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016395		
Client ID: 14-60		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.016
Total Nitrogen	mg/l	0.042
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.07
96-A016396		
Client ID: 14-30		
Chlorophyll a	mg/m3	2.6
Pheophytin	mg/m3	0.17
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.15
96-A016397		
Client ID: 14-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.47
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.009
Turbidity	NTU	0.14
96-A016398		
Client ID: 15-BOTTOM		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.015
Total Nitrogen	mg/l	0.031
Nitrate + Nitrite	mg/l	0.029
Nitrite Nitrogen	mg/l	0.028
Total Phosphorus	mg/l	0.020
Turbidity	NTU	0.06

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016399		
Client ID: 15-60		
Chlorophyll a	mg/m3	0.84
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.014
Turbidity	NTU	0.03
96-A016400		
Client ID: 15-30		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.23
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.09
96-A016401		
Client ID: 15-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.14
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.016
Turbidity	NTU	0.20
96-A016402		
Client ID: 16-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.017
Nitrite Nitrogen	mg/l	0.028
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.20

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016403		
Client ID: 16-120		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.40
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.011
Turbidity	NTU	0.16
96-A016404		
Client ID: 16-90		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.08
96-A016405		
Client ID: 16-60		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	0.43
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.033
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.009
Turbidity	NTU	0.12
96-A016406		
Client ID: 16-30		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.39
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.11

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016407		
Client ID: 16-SURF		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.07
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.18
96-A016408		
Client ID: 17-BOTTOM		
Chlorophyll a	mg/m3	0.74
Pheophytin	mg/m3	0.04
Ammonia Nitrogen	mg/l	0.044
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.012
Total Phosphorus	mg/l	0.048
Turbidity	NTU	0.21
96-A016409		
Client ID: 17-30		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.47
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.22
96-A016410		
Client ID: 17-SURF		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.44
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
Turbidity	NTU	0.19

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016411		
Client ID: 18-BOTTOM		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.012
Nitrite Nitrogen	mg/l	0.022
Total Phosphorus	mg/l	0.015
Turbidity	NTU	0.13
96-A016412		
Client ID: 18-120		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.026
Turbidity	NTU	0.08
96-A016413		
Client ID: 18-90		
Chlorophyll a	mg/m3	0.73
Pheophytin	mg/m3	0.04
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.08
96-A016414		
Client ID: 18-60		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.019
Turbidity	NTU	0.14

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016415		
Client ID: 18-30		
Chlorophyll a	mg/m3	1.5
Pheophytin	mg/m3	0.11
Ammonia Nitrogen	mg/l	0.009
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.020
Turbidity	NTU	0.33
96-A016416		
Client ID: 18-SURF		
Chlorophyll a	mg/m3	1.7
Pheophytin	mg/m3	0.17
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.010
Turbidity	NTU	0.13

AMTEST

METHODOLOGY REPORT

AM TEST ID 96-A016315
CLIENT ID 5-BOTTOM

MATRIX : Water
SAMPLED: 11/21/96

ANALYTE	UNITS	METHOD NUMBER	METHOD REFERENCE	DETECTION LIMIT *	DATE OF ANALYSIS
Chlorophyll a	mg/m3	1002G	SM	0.03	12/ 2/96
Pheophytin	mg/m3	1002G	SM	0.03	12/ 2/96
Ammonia Nitrogen	mg/l	350.1	EPA	0.005	11/27/96
Total Nitrogen	mg/l	351.3M	EPA	0.025	12/ 9/96
Nitrate + Nitrite	mg/l	353.2	EPA	0.010	11/26/96
Nitrite Nitrogen	mg/l	354.1	EPA	0.001	11/25/96
Total Phosphorus	mg/l	365.2	EPA	0.005	12/ 6/96

SM = Standard Methods for the Examination of Water and Wastewater 18th ed.
SW-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods
EPA = Methods for Chemical Analysis of Water and Wastes 1983
* Instrument Detection Limit

AMTEST

Quality Control Summary

QC for 96-A016315 - 96-A016416

DUPLICATES		sample value	duplicate value	RPD %
96-A016315 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016325 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016335 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016345 DUP: Ammonia Nitrogen	mg/l	0.006	0.012	67.
96-A016355 DUP: Ammonia Nitrogen	mg/l	0.008	0.007	13.
96-A016365 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016375 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016385 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016395 DUP: Ammonia Nitrogen	mg/l	0.016	0.012	29.
96-A016405 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016415 DUP: Ammonia Nitrogen	mg/l	0.009	< 0.005	
96-A016315 DUP: Total Nitrogen	mg/l	0.028	0.033	16.
96-A016325 DUP: Total Nitrogen	mg/l	0.060	0.048	22.
96-A016335 DUP: Total Nitrogen	mg/l	0.10	0.095	5.1
96-A016345 DUP: Total Nitrogen	mg/l	0.040	0.040	0.00
96-A016355 DUP: Total Nitrogen	mg/l	0.056	0.052	7.4
96-A016365 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016375 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016385 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016395 DUP: Total Nitrogen	mg/l	0.042	0.037	13.
96-A016405 DUP: Total Nitrogen	mg/l	0.033	< 0.025	
96-A016415 DUP: Total Nitrogen	mg/l	0.049	0.035	33.
96-A016315 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016325 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016335 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016345 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016355 DUP: Nitrate + Nitrite	mg/l	0.031	0.031	0.00
96-A016365 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016375 DUP: Nitrate + Nitrite	mg/l	0.014	0.014	0.00
96-A016385 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016395 DUP: Nitrate + Nitrite	mg/l	0.011	0.013	17.
96-A016405 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016415 DUP: Nitrate + Nitrite	mg/l	< 0.01	0.010	
96-A016315 DUP: Nitrite Nitrogen	mg/l	0.009	0.006	40.
96-A016325 DUP: Nitrite Nitrogen	mg/l	< 0.001	< 0.001	
96-A016335 DUP: Nitrite Nitrogen	mg/l	< 0.001	< 0.001	
96-A016345 DUP: Nitrite Nitrogen	mg/l	0.011	0.010	9.5
96-A016355 DUP: Nitrite Nitrogen	mg/l	0.029	0.030	3.4
96-A016365 DUP: Nitrite Nitrogen	mg/l	0.014	0.014	0.00
96-A016375 DUP: Nitrite Nitrogen	mg/l	0.026	0.025	3.9
96-A016385 DUP: Nitrite Nitrogen	mg/l	0.002	0.001	67.
96-A016395 DUP: Nitrite Nitrogen	mg/l	0.013	0.012	8.0
96-A016405 DUP: Nitrite Nitrogen	mg/l	0.004	0.002	67.
96-A016415 DUP: Nitrite Nitrogen	mg/l	0.010	0.010	0.00

AMTEST

Quality Control Summary
(continued)

QC for 96-A016315 - 96-A016416

96-A016315 DUP: Total Phosphorus	mg/l	0.013	0.014	7.4
96-A016325 DUP: Total Phosphorus	mg/l	0.013	0.011	17.
96-A016335 DUP: Total Phosphorus	mg/l	0.009	0.013	36.
96-A016345 DUP: Total Phosphorus	mg/l	0.027	0.031	14.
96-A016355 DUP: Total Phosphorus	mg/l	0.030	0.036	18.
96-A016365 DUP: Total Phosphorus	mg/l	0.014	0.009	43.
96-A016375 DUP: Total Phosphorus	mg/l	0.019	0.012	45.
96-A016385 DUP: Total Phosphorus	mg/l	< 0.005	0.007	
96-A016395 DUP: Total Phosphorus	mg/l	0.017	0.017	0.00
96-A016405 DUP: Total Phosphorus	mg/l	0.009	0.009	0.00
96-A016415 DUP: Total Phosphorus	mg/l	0.020	0.024	18.
96-A016345 DUP: Turbidity	NTU	0.05	0.05	0.00
96-A016395 DUP: Turbidity	NTU	0.07	0.08	13.
96-A016405 DUP: Turbidity	NTU	0.12	0.12	0.00
96-A016415 DUP: Turbidity	NTU	0.33	0.31	6.3

MATRIX SPIKES

		sample value	sample+spk value	spike value	Recovery %
96-A016316 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.58	0.50	116.
96-A016326 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.57	0.50	114.
96-A016336 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.57	0.50	114.
96-A016346 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016356 SPIKE: Ammonia Nitrogen	mg/l	0.010	0.49	0.50	96.0
96-A016366 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016376 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.51	0.50	102.
96-A016386 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.52	0.50	104.
96-A016396 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016406 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.52	0.50	104.
96-A016416 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.53	0.50	106.
96-A016316 SPIKE: Total Nitrogen	mg/l	0.092	1.1	1.0	101.
96-A016326 SPIKE: Total Nitrogen	mg/l	0.071	1.1	1.0	103.
96-A016336 SPIKE: Total Nitrogen	mg/l	0.039	1.1	1.0	106.
96-A016346 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016356 SPIKE: Total Nitrogen	mg/l	< 0.025	1.1	1.0	110.
96-A016366 SPIKE: Total Nitrogen	mg/l	0.030	1.1	1.0	107.
96-A016376 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016386 SPIKE: Total Nitrogen	mg/l	0.056	1.1	1.0	104.
96-A016396 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016406 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016416 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016316 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016326 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016336 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.49	0.50	98.0
96-A016346 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.51	0.50	102.
96-A016356 SPIKE: Nitrate + Nitrite	mg/l	0.022	0.51	0.50	97.6
96-A016366 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.52	0.50	104.
96-A016376 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.47	0.50	94.0
96-A016386 SPIKE: Nitrate + Nitrite	mg/l	0.027	0.53	0.50	101.
96-A016396 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.51	0.50	102.
96-A016406 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016416 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.49	0.50	98.0

AMTEST

Quality Control Summary
(continued)

QC for 96-A016315 - 96-A016416

96-A016316 SPIKE: Nitrite Nitrogen	mg/l	0.002	0.26	0.25	103.
96-A016326 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016336 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016346 SPIKE: Nitrite Nitrogen	mg/l	0.001	0.27	0.25	108.
96-A016356 SPIKE: Nitrite Nitrogen	mg/l	0.030	0.30	0.25	108.
96-A016366 SPIKE: Nitrite Nitrogen	mg/l	0.004	0.27	0.25	106.
96-A016376 SPIKE: Nitrite Nitrogen	mg/l	0.024	0.30	0.25	110.
96-A016386 SPIKE: Nitrite Nitrogen	mg/l	0.033	0.31	0.25	111.
96-A016396 SPIKE: Nitrite Nitrogen	mg/l	0.004	0.29	0.25	114.
96-A016406 SPIKE: Nitrite Nitrogen	mg/l	0.003	0.28	0.25	111.
96-A016416 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016316 SPIKE: Total Phosphorus	mg/l	0.011	0.20	0.20	94.5
96-A016326 SPIKE: Total Phosphorus	mg/l	0.005	0.21	0.20	102.
96-A016336 SPIKE: Total Phosphorus	mg/l	0.009	0.19	0.20	90.5
96-A016346 SPIKE: Total Phosphorus	mg/l	< 0.005	0.22	0.20	110.
96-A016356 SPIKE: Total Phosphorus	mg/l	0.031	0.22	0.20	94.5
96-A016366 SPIKE: Total Phosphorus	mg/l	0.012	0.19	0.20	89.0
96-A016376 SPIKE: Total Phosphorus	mg/l	< 0.005	0.20	0.20	100.
96-A016386 SPIKE: Total Phosphorus	mg/l	0.010	0.18	0.20	85.0
96-A016396 SPIKE: Total Phosphorus	mg/l	< 0.005	0.20	0.20	100.
96-A016406 SPIKE: Total Phosphorus	mg/l	< 0.005	0.19	0.20	95.0
96-A016416 SPIKE: Total Phosphorus	mg/l	0.010	0.20	0.20	95.0

STANDARD REFERENCE MATERIALS			measured value	true value	Recovery %
Known	SRM: Chlorophyll a	mg/m3	360	310	117.
Known	SRM: Chlorophyll a	mg/m3	360	310	117.
Known	SRM: Chlorophyll a	mg/m3	220	310	71.7
Known	SRM: Chlorophyll a	mg/m3	340	310	110.
Known	SRM: Chlorophyll a	mg/m3	310	310	100.
Known	SRM: Chlorophyll a	mg/m3	260	310	83.9
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	3.9	3.9	100.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	3.8	3.9	97.4
Known	SRM: Ammonia Nitrogen	mg/l	3.8	3.9	97.4
Known	SRM: Ammonia Nitrogen	mg/l	3.4	3.9	87.2
Known	SRM: Ammonia Nitrogen	mg/l	3.7	3.9	94.9
Known	SRM: Ammonia Nitrogen	mg/l	4.0	3.9	103.
Known	SRM: Ammonia Nitrogen	mg/l	3.9	3.9	100.

AMTEST

Quality Control Summary
(continued)

QC for 96-A016315 - 96-A016416

Known	SRM: Total Nitrogen	mg/l	4.0	3.9	103.
Known	SRM: Total Nitrogen	mg/l	6.4	7.8	82.1
Known	SRM: Total Nitrogen	mg/l	6.7	7.8	85.9
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	88.5
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	88.5
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	88.5
Known	SRM: Total Nitrogen	mg/l	3.9	4.1	94.2
Known	SRM: Total Nitrogen	mg/l	7.4	7.8	94.9
Known	SRM: Total Nitrogen	mg/l	7.2	7.8	92.3
Known	SRM: Total Nitrogen	mg/l	7.1	7.8	91.0
Known	SRM: Nitrate + Nitrite	mg/l	7.3	7.0	104.
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	7.0	7.0	100.
Known	SRM: Nitrate + Nitrite	mg/l	7.0	7.0	100.
Known	SRM: Nitrate + Nitrite	mg/l	6.5	7.0	92.9
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.8	7.0	97.1
Known	SRM: Nitrate + Nitrite	mg/l	6.8	7.0	97.1
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	2.0	1.9	105.
Known	SRM: Total Phosphorus	mg/l	1.9	1.9	100.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.6	1.9	84.2
Known	SRM: Total Phosphorus	mg/l	1.9	1.9	100.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Turbidity	NTU	1.2	1.3	92.3
Known	SRM: Turbidity	NTU	1.2	1.3	92.3
Known	SRM: Turbidity	NTU	1.3	1.3	100.
Known	SRM: Turbidity	NTU	1.3	1.3	100.

BLANKS

Result

AMTEST

Quality Control Summary
(continued)

QC for 96-A016315 - 96-A016416

BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001

AMTEST

Quality Control Summary
(continued)

QC for 96-A016315 - 96-A016416

BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Turbidity	NTU	< 0.01
BLANK: Turbidity	NTU	< 0.01
BLANK: Turbidity	NTU	0.02
BLANK: Turbidity	NTU	0.02

Appendix VI

Laboratory Results for Zinc and Copper

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 15-30**
TOTAL METALS

Lab Sample ID: Q898A
LIMS ID: 96-20204
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: 15-30
Lab Sample ID: Q898A — QC Report No: Q898-CH2M Hill
LIMS ID: 96-20204 — Project: JCO Harbor W/Q Study
Matrix: Water — 107091.WQ.96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.002 U	0.000	0.000	NA	
Zinc	0.02 U	0.46	0.50	92.0%	

'Q' codes:
- N = control limit not met
- H = %R not applicable, sample concentration too high
- * = RPD control limit not met
- NA = Not applicable - analyte not spiked

Control Limits:
- Percent Recovery: 75-125%
- RPD: +/-20%

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 15-60**
TOTAL METALS

Lab Sample ID: Q898B
LIMS ID: 96-20205
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: Q898B
LIMS ID: 96-20205
Matrix: Water

Data Release Authorized:
Reported: 12/17/96

Sample No: 15-60
QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Received: 11/25/96

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Zinc	0.02 U	0.02 U	0.0%	+/- 0.02	L

'Q' codes: * = control limit not met
L = RPD not valid, alternate limit = detection limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 15-Botm**
TOTAL METALS

Lab Sample ID: Q898C
LIMS ID: 96-20206
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 16-30**
TOTAL METALS

Lab Sample ID: Q898D
LIMS ID: 96-20207
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: 16-30
Lab Sample ID: Q898D
QC Report No: Q898-CH2M Hill
LIMS ID: 96-20207
Project: JCO Harbor W/Q Study
Matrix: Water
107091.WQ.96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.002 U	0.002	0.002	100%	
Zinc	0.02 U	0.00	0.00	NA	

'Q' codes:
N = control limit not met
H = %R not applicable, sample concentration too high
* = RPD control limit not met
NA = Not applicable - analyte not spiked

Control Limits:
Percent Recovery: 75-125%
RPD: +/-20%

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 16-120**
TOTAL METALS

Lab Sample ID: Q898E
LIMS ID: 96-20208
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: 16-Botm

Lab Sample ID: Q898F
LIMS ID: 96-20209
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 18-30**
TOTAL METALS

Lab Sample ID: Q898G
LIMS ID: 96-20210
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No:** 18-120
TOTAL METALS

Lab Sample ID: Q898H
LIMS ID: 96-20211
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 18-Botm**
TOTAL METALS

Lab Sample ID: Q898I
LIMS ID: 96-20212
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 5-30**
TOTAL METALS

Lab Sample ID: Q898J
LIMS ID: 96-20213
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 5-120**
TOTAL METALS

Lab Sample ID: Q898K
LIMS ID: 96-20214
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No:** 5-Botm
TOTAL METALS

Lab Sample ID: Q898L
LIMS ID: 96-20215
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 5A-30**
TOTAL METALS

Lab Sample ID: Q898M
LIMS ID: 96-20216
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 5A-120**
TOTAL METALS

Lab Sample ID: Q898N
LIMS ID: 96-20217
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATEI

INORGANICS ANALYSIS DATA SHEET **Sample No: 5A-Botm**
TOTAL METALS

Lab Sample ID: Q8980
LIMS ID: 96-20218
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/21/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 11-30**
TOTAL METALS

Lab Sample ID: Q898P
LIMS ID: 96-20219
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/20/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 11-120**
TOTAL METALS

Lab Sample ID: Q898Q
LIMS ID: 96-20220
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/20/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 11-Botm**
TOTAL METALS

Lab Sample ID: Q898R
LIMS ID: 96-20221
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/20/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 13-Surf**
TOTAL METALS

Lab Sample ID: Q898S
LIMS ID: 96-20222
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/20/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: 13-Botm**
TOTAL METALS

Lab Sample ID: Q898T
LIMS ID: 96-20223
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: 11/20/96
Date Received: 11/25/96

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: Q898T
LIMS ID: 96-20223
Matrix: Water

Data Release Authorized:
Reported: 12/17/96

Sample No: 13-Botm
QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Received: 11/25/96

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Copper	0.002 U	0.002 U	0.0%	+/- 0.002	L

'Q' codes: * = control limit not met
L = RPD not valid, alternate limit = detection limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: Method Blank

Lab Sample ID: Q898MB
LIMS ID: 96-20204
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7M	12/05/96	6010	12/11/96	7440-50-8	Copper	0.002	0.002 U
CLP	12/05/96	6010	12/11/96	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: Q898LCS
LIMS ID: 96-20205
Matrix: Water

QC Report No: Q898-CH2M Hill
Project: JCO Harbor W/Q Study
107091.WQ.96

Data Release Authorized:
Reported: 12/13/96

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.229	0.250	91.6%	
Zinc	0.97	1.00	97.0%	

'Q' codes: N = control limit not met

Control Limits: 75-125%